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# ARCHIVES

OF

# OTOLOGY

*EDITED IN ENGLISH AND GERMAN*

BY

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OF NEW YORK

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## ARCHIVES OF OTOLOGY.

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### NERVE ATROPHY IN THE FIRST COCHLEAR CONVOLUTION: ITS PHYSIOLOGICAL AND PATHOLOGICAL IMPORTANCE.

BY S. MOOS AND H. STEINBRÜGGE, OF HEIDELBERG.\*

Translated by I. FURST, of New York.

(With lithographic Plate i.)

FOR the opportunity to study and examine the following case, and for its history, we are indebted to Prof. Erb, in whose wards the patient was placed, and who has published and detailed, in the *Deut. Arch. f. klin. Med.*, Bd. xiii, H. 1 and 2, pp. 172 *et seq.*, this, also in a neuropathological sense, exceedingly interesting case.

Anton Gref, æt. 63, a mason from Friedrichsfeld, was admitted October 26, 1878, to the electro-therapeutic ward of Prof. Erb.

Patient had observed the commencement of his trouble some two weeks before. He awoke at night about three o'clock, when his left arm was tossed in various directions by convulsive movements. There were tonic and clonic spasms in the left arm.

After the spasms ceased, great weakness remained in the arm; motion was possible only after some time. These attacks have recurred six times until the present; no new phenomena have been developed. Right arm healthy. The left leg appears to patient to be a little weaker. No headache, only now and then some vertigo. Consciousness unimpaired during the attacks. Mastication, deglutition and articulation good.

*Status præsens.*—A tall, vigorous, for his age comparatively well-looking man. Inspection at once reveals that the left hand is red,

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\* Paper read September 6, 1880, by S. Moos before the Second International Otological Congress, at Milan.

the fingers being rather glossy and slightly œdematous. The arm depends nearly immovably from the shoulder joint.

Walking and standing good. Legs rather muscular, motor power not sensibly diminished. No disturbances of sensibility.

Patellar tendon reflexes very strong on both sides. Left side, distinct dorsal clonus; right, slightly indicated; bilaterally, reflex of adductors. Plantar reflex on the left very distinct; on the right, weak. Cremaster and abdominal reflexes distinct on both sides.

Triceps tendon reflex in both arms, and reflex in the biceps muscles on tapping the carpal extremity of the radius.

Nothing of importance in the right arm. Slight emaciation of the left arm. Muscles and nerves respond to faradic and galvanic irritation. No degenerative reaction.

*Oct. 4th.*—Patient has again had tremors in the left arm and in the left leg as well. Some vertigo for two days past.

*Oct. 9th.*—Another attack of tremors during the night. Arm is again weaker. Tremors are also noticeable in the left leg, with succeeding weakness. Paresis of the muscles of the thigh particularly.

*Oct. 18th.*—Vision, motions of eye, mimic motions, mobility and position of tongue normal. Sensibility of face normal, uvula straight. Soft palate, during phonation, perhaps moved a little better on the left than on the right side. Left upper extremity almost completely paralyzed; slight motions may be excited in the biceps, brachialis internus and pectoralis major. Sensibility perfectly normal. Tendon reflexes more vivid on the left than on the right side.

*Oct. 19th.*—Left leg decidedly paretic, gait dragging and rather scraping; standing on the left leg is difficult; no staggering on closing the eyes. No ataxia. Sensibility quite normal. Mechanical irritability of the muscles greater than on the right; tendon reflexes increased in both legs, but more so on the left than on the right. Urinary and alvine evacuations normal. Spine and formation of skull normal. Rapping on the head is not painful.

*Oct. 21st.*—Patient had four attacks yesterday. Ice-bladder to the head. Laxative water.

*Oct. 22d.*—Potassium bromide, eight grammes; potassium iodide, four grammes.

*Oct. 26th.*—Urine normal in color and quantity; sp. gr. 1.009; free from albumen or sugar.

*Oct. 31st.*—Had six attacks since yesterday, each lasting about eight minutes. *Sensation of vertigo and headache*; the latter chiefly located in the right frontal region. Temperature in the right axilla, immediately after an attack,  $36.6^{\circ}$ ; left,  $37^{\circ}$ . Pulse, after an attack, 80.

*Nov. 2d.*—Two attacks yesterday. Temperature since yesterday morning *continuously lower* in the right axilla than in the left, while hitherto the difference existed only after an attack.

*From Nov. 3d to Nov. 25th.* From one to four attacks every two to four days; after that date, until death, only a few slight attacks.

*Nov. 25th.*—Twitching of muscles of face. Left lower extremity almost completely paralyzed.

*Dec. 10th.*—Ophthalmoscopic examination by Dr. Kuhnt. Dilation of veins and slight œdema of optic disc in the left eye; no œdema in right eye. Progressive paralysis of deglutition.

*Dec. 21st.*—Slight double neuritis, more pronounced in left eye. Incontinence of urine.

*Dec. 31st.*—*Exitus letalis.*

*Clinical diagnosis.*—Hemiparesis lateralis sinistra from a cortical affection of the right central convolution.

*Autopsy.*—Carcinoma of the right anterior central convolution. Carcinoma of the stomach.

The *examination of the organ of hearing* was made two weeks before death. Following is the result:

Adam Gref, æt. 63, mason. Sick since 1870. Suffers from impaired hearing, particularly on the right side, and from continuous tinnitus. The ear affection is said to have occurred suddenly. Membrana tympani unaltered on both sides. Hearing distance for speech—right = 0; left = 3 metres.

With Politzer's acoumeter—right = 0.01 metre; left = 0.02 metre.

Bone-conduction for the watch from the temple—right = 0; left, weak.

Tuning-forks from the forehead:

a'*	is perceived	
c'	" "	right.
c	" "	"

Tuning-forks by air-conduction:

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\* C = 66 vibrations per second; c = 132; c' = 264; A = 110; a = 220; a' = 440.—K.

Right.	Left.
$a' = 0,$	$a' =$ barely heard,
$c' = 0,$	$c' = 0.05$ metre,
$c = 0.01$ metre.	$c = 0.01$ "

*Post-mortem Appearance of the Right Petrous Bone.*

Erosions and dehiscences on the base of the pyramid to an extent of  $2\frac{1}{2}$  cm. in the direction of the longitudinal axis, and of 2 cm. in the direction of its transverse axis. The roof of the glenoid fossa is thinned so as to appear translucent. The longitudinal diameter of this oval erosion corresponds to that of the articular cavity and measures 0.01 cm., while its transverse diameter measures 0.007 cm. The greatest number of the before-mentioned dehiscences is above the mastoid antrum.

Air blown through the tube by a catheter causes a slight blowing noise on auscultation, no rattling. The mucous membrane of the tympanic cavity and of the ossicles is normal. The malleo-incudal and incudo-stapedial joints are movable. Stapes with difficulty movable in the fenestra ovalis. Membrana tympani and manubrium mallei normal. The mastoid process seems to be in a state of sclerotic thickening, with diminution of the collective capacity of the cellular spaces it contains. The sclerosed bone measures from the outside to the centre of the posterior border of the sigmoid fossa, 0.02; from the posterior wall of the auditory meatus to the mastoid antrum, 0.005; from the base of the styloid process to the commencement of the cellular spaces, 0.011 cm.

*Microscopic Appearance of the Right Labyrinth.*

Method of examination: Comp. these ARCHIVES, vol. ix, pp. 113 et seq.

*Condition of the central termination of the acoustic nerve and its trunk in the porus acusticus internus, and of the internal auditory artery.* The greater part of the nerve-fibres was normal; atrophic ones were only exceptionally found. The atrophy was characterized by the loss of the medullary sheath, so that only the axis-cylinder was preserved; besides, granulated cells were encountered here and there. The ganglion-cells of the nervus vestibuli were in part very small.



The branches of the internal auditory artery, as far as the canal of Rosenthal, were to a great extent in atheromatous degeneration. Their walls showed spots of fusiform thickenings, and their sheaths contained multiple smaller and larger, variously shaped but mostly rounded concretions \* of phosphate of lime.

The nerve-fibres of the lamina spiralis ossea of the second and third cochlear convolutions exhibited a normal appearance and their number did not seem to be diminished. Perhaps there were fewer transverse anastomoses. The nerve-fibres of the *first convolution* of the lamina spiralis ossea, however, showed remarkable alterations (comp. figs. 2, 4 and 6). In *surface preparations*, the single bundles of nerve-fibres, immediately after passing through the modiolus and in their course to the lamina spiralis membranacea, appeared narrower and more transparent than under normal conditions. The transverse anastomoses were less numerous, and the network formed by them had larger meshes than normally.

*Vertical sections* through the lamina spiralis ossea of the *first convolution* displayed, instead of the broad bundles of nerves present in the normal state, only extremely sparse, isolated, radiating nerve-fibres. The latter were interrupted in some places by small lacunæ which, in their turn, were filled in part by transverse sections of spiral fibres (comp. fig. 4). *Therefore the case was one of quantitative atrophy of the nerve-fibres in the lamina spiralis ossea of the first cochlear convolution.*

The condition just described was still further elucidated by examination with Hartnack's immersion objective No. 9 and eye-piece No. 3. Under this magnifying power, too, we found an evident disappearance of nerve-fibres; while the remaining ones were represented solely by detritus or fractional portions of some single and some aggregated radial or spiral, abruptly terminating fibres. This sudden break in the single fibres conveyed the impression that they

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\* Such were also found in the sheath of the cochlear nerve, and in the wall of a vessel of the connective-tissue layer in the superior semicircular canal; this layer, moreover, was thickened. The length of one of the larger concretions was 0.084 mm., its width, 0.017—0.023 mm.

were torn off, but the condition could by no means have been artificial: first, because the lamina spiralis ossea was detached, with the greatest care, immediately at the modiolus, and especially, secondly, because the processes\* situated on its upper plate were preserved intact.

Aside from the alterations just described, these remnants of nerve-fibres showed distinct *varicosities* alternately with deep indentations. Withal, the double outline was preserved throughout, and the varicosity was particularly caused by fusiform and club-shaped swellings of the axis-cylinders. Besides, in some places, the nuclei of Schwann's sheath were enlarged, and a few of the varicose-hypertrophied nerve-fibres contained, in addition, a roundish or irregularly shaped, sometimes brighter, sometimes darker corpuscle.

Some varicose nerve-fibres were also found in the *canal of Rosenthal*. The number of the at times nucleated, at times non-nucleated ganglion-cells found there was exceedingly small. The contents of the non-nucleated cells were homogeneous. The nuclei were only exceptionally stained in carmine solution, and the cell-contents, where they were homogeneous, took either a faint coloration or remained colorless.

*Condition of the hair cells.*—After an immersion of vertical sections of the first cochlear convolution in a carmine solution during twenty-one hours, the hair cells remained uncolored. Otherwise, only the external ones displayed a normal appearance. In the place of the inner ones, there was a finely-granular, molecular, colorless mass. In the second cochlear convolution, a great part of the hair cells appeared perfectly normal; some had no nucleus and made the impression of large, oval, granulated cells. No pathological changes were found in the third cochlear convolution.

Regarding the lamina basilaris membranacea, a uniform dilatation of the perivascular lymph-sheaths should be mentioned (see fig. 6). While in various normal preparations

\* For these compare the illustration furnished by Waldeyer, fig. 325, in Stricker's "Gewebelehre," Bd. ii, p. 928. On intact preparations, as is well known, they may be seen by focussing high, while the nerve-fibres situated underneath become distinctly visible by focussing low.



of the lamina spiralis membranacea we found the diameter of the perivascular lymph-spaces on each side of the vessel as large as the diameter of the blood-vessel itself, in our case it was two, three to five times as wide. This dilatation was uniform throughout, with the exception of a single partially dilated lymph-space within the lamina spiralis ossea (first cochlear convolution, near the modiolus).

*Condition of the membranous parts of the vestibule and its annexes:*

The cells of the ligamenta labyrinthi\* were partly normal, partly non-nucleated, with homogeneous contents, which were but faintly stained by carmine. The membrana propria was not materially changed. The epithelial layer of the semicircular canals, which was normal in some places, showed in others fatty and colloid degeneration, with a great number of granulated cells.

Similar alterations were found in the epithelial cells of the utricle. The most striking changes were in the epithelial layer of the ampulla of the horizontal semicircular canal. The specimen in question, which, after prolonged immersion in carmine solution, had assumed only an extremely faint coloration, exhibited a great variety in the form and size of its epithelial nuclei. Many were no longer homogeneous but granulated; where the round form was still preserved, they only represented empty rings of rows of granules, arranged like strings of beads. The cell-wall frequently showed the same condition. The cell-contents were either homogeneous, or likewise granulated and colorless.

The nerve terminations in the utricle and ampullæ showed nothing abnormal. The preparations of the sacculus unfortunately did not succeed sufficiently well to permit us to form a positive opinion of the conditions.

*Remarks.*—The main results of the above-described alterations may be summed up in the following:

The external ear, membrana tympani, and the apparatus of the tympanic cavity were normal, with the exception of the stapedio-vestibular joint. The sclerosis of the cells of

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\*Comp. these ARCHIVES, vol. ix, p. 116.

the mastoid process probably does not enter into the consideration of the disturbances in the auditory function. Of greater importance is the defective mobility of the stapes in the fenestra ovalis. This condition, as the sole anatomical condition in morbid processes in the tympanic cavity, has been observed, though rarely, also by other investigators, for instance, Schwartz, and in our case has probably developed gradually in the course of some years. It may be looked upon as one of the causes of the impaired hearing and of the subjective auditory perceptions; at all events, it implied an increase of the intralabyrinthine pressure. Inasmuch as the patient stated that his affection commenced suddenly, the possibility cannot be excluded that, aside from the above-described alteration in the stapedio-vestibular joint, an exudation into the labyrinth may have taken place at the onset of the disease.

However, an assumption of that kind for the explanation of the atrophy in the first cochlear convolution is not absolutely necessary. With the increased intra-aural pressure which had been present for years, and which, possibly, in the last few months of life had become still higher by the development of a cerebral new-formation,\* we may, on the one hand, imagine a simple atrophy by inactivity; while, on the other hand, the atheromatous alterations found in the branches of the internal auditory artery, or, finally, a lymph-stasis, caused by increased pressure, may serve to explain the above-described nerve atrophy.

In our case, if we speak of an atrophy by inactivity of the nerve-fibres in the first cochlear convolution, we have pre-eminently in view the important fact found by C. Burnett under the direction of Helmholtz, that *under artificially increased labyrinthine pressure*, the vibrations, transmitted by means of the sound-conducting apparatus to the labyrinthine fluid, were *weaker in the transmission of high tones* than when low tones were made to act on the membrana tympani. Burnett demonstrated this decrease of the vibrations during the experiments with high tones, by observing the oscillations of the membrane of the fenestra rotunda,

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\*Otherwise the neoplasm has no connection with the impairment of hearing.

and found even a complete cessation of these as soon as the intralabyrinthine pressure was still further increased.

In applying the result of these investigations to the case under consideration, we see that, in consequence of the increased intra-aural pressure, the labyrinthine fluid was no longer set in motion by the high tones, and the strings of the zona pectinata in the lower convolution, therefore, were no longer brought into sympathetic vibration with tones corresponding in the number of vibrations with their length and tension. Thus the possibility was furnished that the nerve-fibres, terminating at the cells of Corti, of these strings were subjected to an atrophy by inactivity starting from the periphery, without forcing us to assume an inflammatory or degenerative process in the tissues of the cochlea.\* Also, the above-described alteration of the external hair cells in the first cochlear convolution might be referred to a similar atrophy developing from the periphery.

*The existing lymph-stasis may perhaps have contributed to effect the atrophy of the nerve.* As was more fully stated above, we found the perivascular lymph-sheaths in the first convolution dilated. However, we know from the investigations of Kühne and Rumpff† that the normal nutrition of the nerves depends not alone upon the integrity of their connection with the central organ, but also upon the nor-

\* On account of the great analogy in regard to the atrophy by inactivity, we briefly report the following: Dr. Samelsohn exhibited at the meeting of the Niederrheinische Gesellschaft für Natur- und Heilkunde, in Bonn, January 19, 1880 (comp. *Berlin klin. Wochenschr.*, No. 23, 1880), the chiasma of the optic nerves of a man of 45, who had died of fracture of the base of the skull. The left eye had been atrophied for some time, and for this reason Dr. Samelsohn instituted an examination of the nerves. He found a remarkable atrophy of the left optic nerve and of both tracts, particularly the right one. Besides, the left globe had no longer any normal retinal elements. Horizontal sections of the chiasm, stained with carmine, yielded no difference in the coloration of the fibres. The thinned optic nerve was then divided into transverse sections, and it was proved that no *atrophy of the nerve-substance* existed anywhere. The septa were of the same width as those of the normal right nerve, nor was the connective tissue increased in any way. It had to be assumed, therefore, that *a part of the nerve bundles had perished without leaving a trace*—a process which has been already described by Leber as existing in the stumps of the optic nerves of atrophied eyes, while such a thinning of the entire nerve-trunk as far as the tractus, without atrophy of the single fibres, seems to have been demonstrated for the first time in this case.

† Zur Histologie der Nervenfasern und des Achsencylinders. Von Dr. Th. Rumpff. Untersuchungen aus dem physiologischen Institut der Universität Heidelberg, Bd. ii, H. 2.

mal connection of their terminal fibres with the formations innervated by them; in other words, that the latter, too, contribute to their nutrition. Moreover, Rumpf (*ibidem*) has found that nerve-fibres, which had been deprived of their normal connection by section, when immersed in lymph, showed a dissolution of their axis-cylinder even after a few hours. If we should be permitted to draw from these interesting investigations conclusions bearing on our case, it would seem plausible to interpret the above-described dilatation of the perivascular lymph-spaces in this sense, and to refer the surprising disappearance of the nerve-fibres within the lamina spiralis ossea, at least in part, as regards the axis-cylinder, to the effect of the stagnant, superabundant lymph. That such a lymph-stasis must occur in continued increased intralabyrinthine pressure is easily comprehensible if we bear in mind that the lymph-channels of the cochlea are in immediate connection, by endosmotic processes, with the remainder of the labyrinthine fluid.

We felt constrained to enter more fully into these investigations, although they have again been put in question by a paper quite recently published by Engelmann.\* Engelmann, namely, denies the dissolution of the axis-cylinder in lymph, and also the nutrition of the nerves from the terminal organs.

As regards the *varicose hypertrophy* found in the remaining nerve-fibres and their detritus, its satisfactory interpretation cannot easily be conformed to the above-described deductions. Perhaps it represents a transitional stage previous to the total disintegration of the fibre. The processes during an atrophy by inactivity, however, are for the present too little known to enable us to employ the hypertrophic condition in explanation of its development. Neither did we find in previous treatises on varicose hypertrophy of the nerve-fibres † any explanatory data, as they,

\* Ueber die Discontinuität des Achsencylinders und den fibrillären Bau der Nervenfasern. By Th. W. Engelmann, of Utrecht. *Pflüger's Archiv*, Bd. xxii, H. 1 and 2.

† Comp. a. Ueber Hypertrophie der Nervenprimitivfasern in der Retina. By H. Müller. *Gräfe's Archiv*, Bd. iv, 2, p. 47. b. Beiträge zur Kenntniss der varicösen Hypertrophie der Nervenfasern. By Dr. M. Roth. *Virchow's Archiv*, Bd. lv, p. 197. c. Krankheiten der Netzhaut und des Sehnerven. By Leber. *Gräfe und Samisch's "Handbuch,"* Bd. v, p. 578.

in the majority of cases, referred only to non-medullated fibres or processes of ganglion-cells, and throw no light upon the later condition of hypertrophic nerve-fibres.

The above-described atrophy of the nerve-fibres in the first cochlear convolution furnishes a pathologico-histological demonstration in favor of Helmholtz's theory of tone-perception. After Hensen had shown by comparative measurements that the radial length of the lamina basilaris membranacea increases in the direction from the fenestra rotunda to the cupola of the cochlea—according to Hensen it is about twelve times as large above as below,—Helmholtz thought himself justified in declaring that the nerve-fibres in the neighborhood of the fenestra rotunda served in effecting the perception of high tones, while those situated higher up were intended for the reception of lower tones. In fact, the result of the functional test,\* taken in connection with the pathological condition in the first cochlear convolution, is in full harmony with this hypothesis of Helmholtz. It, moreover, again confirms that the understanding of speech presupposes a normal perception of the higher musical tones. In this respect we refer to a paper published in this journal as early as 1872, by Moos.† Should the present observation and its explanation be confirmed by a more ample experience, it would acquire particular importance in a clinical point of view. Let us illustrate this by one instance, *i. e.*, auditory disturbances after cerebro-spinal meningitis. We know that this affection extends in either of two ways to the organ of hearing: through the petroso-squamous fissure into the drum cavity (Klebs, Moos), or through the porus acusticus internus into the labyrinth (Niemeyer, Heller, Lucæ, Knapp, and others).

\* Patient perceived the once-marked *a*, on the right side, neither by air, nor bone-conduction; while *c'* and *c* were perceived on the right side through the bone, and the latter also by air-conduction. Unfortunately, the test had been limited to these few tuning-fork tones, because the patient could be examined only *once* in the hospital on account of his great weakness and the speedy fatal termination. Concerning the test with the physharmonika, we desire to point out that it could certainly be of use in bilateral affection of the labyrinth; but, in cases of unilateral lesion, the difficulty of excluding the function of a normal ear by plugging of the meatus being well known, it could easily give rise to mistakes just on account of its intensity of tone.

† "Pathological Observations on the Physiological Importance of the Higher Musical Tones." ARCHIVES OF OPHTH. AND OTOL., iii, 1, p. 113.



Only the latter mode of extension enters into the present consideration. In this case either complete deafness exists, or, according to the present experience of Moos, *only the perception of high musical tones is destroyed or weakened*, and the understanding of speech correspondingly impaired. Possibly this may be due to the fact that the lower cochlear convolution is in such cases more particularly endangered than the upper two, because, on the one hand, the lower convolution is more easily reached when the morbid process extends from the cranial cavity; on the other hand, because the nerves between the bony plates of the lamina spiralis ossea suffer more particularly in their function from the pressure of the supposed exudation, since there they have to traverse a greater distance to reach the passage in the zona perforata than in the two upper convolutions.

#### *Historical Review.*

To aid the reader in appreciating the above-mentioned importance of the higher musical tones in the understanding of speech, we beg to add the following historical notes on this subject. In *Cannstadt's Jahresbericht* for 1872, on the progress of otology, Lucæ expresses himself to this effect:

"From some cases of affection of the inner ear reported by Moos it appears that the higher tones seem to have greater importance in the understanding of speech than the lower ones; further, in many so-called nervous affections of the ear, the answer to the question, whether a patient hears the higher musical tones clearly, faintly, or not at all, may concern likewise the prognosis regarding a possible restoration of the acuity of hearing for speech. The test was made with a piano of seven octaves. The reviewer can confirm the author's statements from his own experience, but begs to remark that, in the examination, the physharmonika, owing to the greater intensity of its higher tones, furnishes more reliable results than the piano."

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\* See above, l. c., p. 113.

In *Cannstadt's Jahresbericht*, 1874, p. 634, Lucæ makes the following remarks in regard to further observations by Moos: \*

"In the *Jahresbericht* for 1872, the reviewer has already confirmed the author's observations, but he cannot concur in their above-mentioned prognostic value. According to the investigations of reviewer, extending over several years, the complete perception of the whole gamut is essential to a normal comprehension of human speech. Therefore, if there exist anywhere a defect of tones or a material impairment of the perception of tones, it would generally have an injurious effect upon the understanding of speech, without for the present enabling us to say positively whether it is prognostically favorable to possess a particularly acute ear for this or that section in the gamut."

In a later essay,† concerning a man aged 45, quite deaf from his sixth year, with speech like that of a deaf-mute, and at the same time blind from retinitis pigmentosa, Lucæ expresses himself as follows:

"There can be no doubt that the complete loss of the higher musical tones, to which the normal acoustic nerve reacts most sensitively, with certainty indicates an affection of the inner ear. In this respect I refer to the observations on the total loss of the higher musical tones published by Schwartz, Moos and myself."

He then recommends again the physharmonika as the test instrument, and reports two cases. The first case was dissected eighteen days after the examination. During life the low tones from *c'* downward were perceived much better than the high ones, and words only when spoken loudly and directly into the ear. It could not be positively determined whether the hearing on the right side was better than on the left. At the autopsy, the condition found was mainly that of chronic catarrh of the middle ear, on both

\* On defective perception of certain consonants, combined with a similar defect as regards high musical notes; with the physiological significance of the same. *ARCH. OPHTH. AND OTOL.*, vol. iv, p. 469.

† Die bei Schwerhörigen zu beobachtende gute Perception der tieferen musikalischen Töne und die physiologische und diagnostische Bedeutung dieser Erscheinungen, nebst Section zweier bei Lebzeiten beobachteter Fälle. *Archiv f. Ohrenheilk.*, Bd. xv, H. 4, pp. 273 et seq.

sides, of the secretory form; further, the *striæ acusticæ* hardly developed at all, and the acoustic nerves in general normal, only the fibres of the left nerve slightly paler and narrower. In both *sacculi commun. et rotund.* were a large number of black concretions of lime. They were looked upon as the residues of an inflammation of the labyrinth which had run its course in the first years of life. The fact that the patient during life did not hear whispered speech or faint noises is explained by Lucaë, in accordance with Helmholtz's theory, by the coarse alterations in the vestibule; while, in his opinion, the rather well-preserved perception of musical tones found its explanation in the fact that no such coarse alterations were present in the cochlea. "But just why the lower tones were heard more easily than the high ones, I am, of course, unable to determine." Should, perhaps in this case, too, a portion of the nerve-fibres in the first cochlear convolution have disappeared?

In the second case likewise (comp. the original, l. c.), Lucaë thinks we might draw the conclusion, bearing Helmholtz's theory in mind, that not all the fibres "of the portion of the cochlea affected with atrophy had become unable to functionate, unless we prefer to seek the reason for that symptom in the still almost normal condition of the vestibular branch." It is to be regretted that Lucaë did not undertake a careful examination of the condition of the nerve-fibres in the different cochlear convolutions; perhaps he would then have been enabled to give a positive instead of a hypothetical explanation of the disturbance of function observed during life. It is difficult to understand how we could harmonize the atrophy of the left vestibular branch, described by Lucaë, with the above-mentioned functional disturbances.

#### *Explanation of Figures.*

In order to facilitate a comparison of the atrophic portions of the nerves with the healthy condition, we had the normal proportions of the nerve distribution in the first cochlear convolution drawn in figs. 1 and 3. The petrous bones serving for the nor-



mal preparations have been decalcified in precisely the same manner as that of Gref.

Fig. 1.—Hartnack obj. 2, eye-piece 3. A segment of a surface preparation of the lamina spiralis ossea from the first convolution of the left cochlea of a man of 19, with normal hearing, who died of pneumonia. We see some of the larger bundles of nerve-fibres, immediately after emerging from the modiolus, in their course toward the commencement of the lamina spiralis membranacea, dividing into smaller branches. By numerous transverse anastomoses between the main trunks and their branches, a net is formed with predominating narrow meshes.

Fig. 2.—A segment, likewise from the first cochlear convolution, of the right petrous bone of Gref, *under the same magnifying power*. The single bundles of nerve-fibres, immediately after emerging from the modiolus, and in their course to the lamina spiralis membranacea, are narrower and consequently present a lighter appearance. The transverse anastomoses are less numerous than in fig. 1, and the network formed by them, therefore, has wider meshes.

Fig. 3.—A vertical section through the lamina spiralis ossea, membranacea, and the organ of Corti supported by it. Preparation from a woman of 42, with normal hearing, who had died of tuberculosis. Hartnack obj. 4, eye-piece 3. We see the nerve-fibres situated between the two plates of the lamina spiralis ossea, in their course toward the introitus (*d*), in front of the inner pillar of the organ of Corti. They form a bundle widest toward the inside, gradually decreasing as it approaches the place named. *mr*, a fractional part of the membrane of Reissner. *cs*, crista spiralis. *ri*, region of the internal hair cells. *ra*, region of the external hair cells.

Fig. 4.—Vertical section *through the same region* of Gref's right cochlea, same magnifying power. Instead of the dense nerve-bundle, we see only exceedingly sparse, isolated, chiefly radial nerve-fibres. Where these are interrupted by vacuolæ, we see transverse sections of some spiral fibres which we have designated above as transverse anastomoses.

Fig. 5.—A segment of the surface preparation No. 2. Hartnack objective No. 9 (immersion), eye-piece 3. We see partly single, partly aggregated, as well as radial and spiral remnants of nerve-fibres which appear as if torn off. All of them still have a double outline and exhibit partly fusiform, partly club-shaped

swellings interspersed with contractions. The varicosities are mainly caused by expansion of the axis-cylinders. Besides, in some places the nuclei of Schwann's sheath are enlarged. Some of the varicose-hypertrophied nerve-fibres contain still a roundish or irregularly shaped, sometimes brighter, sometimes darker corpuscle.

Fig. 6.—Hartnack obj. 4, eye-piece 2. We see the perivascular lymph-sheath of a blood-vessel from a surface preparation of the lamina basilaris membranacea of the right petrous bone of Gref. The diameter of the perivascular lymph-space on each side of the vessel equals about double the calibre of the blood-vessel.

## A RARE CASE OF STAB-WOUND OF THE LEFT HALF OF THE SKULL,

WITH TEMPORARY IRRITATION OF THE LEFT OCULOMOTOR  
AND VAGUS NERVES, AND PERMANENT (?) PARALYSIS OF  
THE LEFT FACIAL AND ACOUSTIC. USE OF TUNING-  
FORK TESTS IN THE DIAGNOSIS OF INJURIES OF THE  
SKULL.

By S. MOOS, OF HEIDELBERG.\*

Translated by ISIDOR FURST, of New York.

"A college boy, æt. 17, son of a physician, was stabbed, March 19, 1880, shortly after 7 P.M., with a knife, the point of which had been broken off previously. The wound was in the left half of the skull, midway between eye and ear, and at the level of the frontal sinus. The blade was so firmly impacted that it could be withdrawn only by a vigorous pull of a comrade (who, however, could not remember how deeply the knife had penetrated into the skull). The wounded young man did not lose consciousness, but grew 'almost maniacal,' fell on his knees and vomited copiously. I saw him on the following day at ten o'clock, or fifteen hours after the infliction of the injury, and found continuous vomiting, a cephalic pulse of 60, paresis of the left facial nerve, deafness of the left ear with loud tinnitus, and slight luscitas (diverging), but no diplopia. The wound was covered with a bloody scab, and three-fourths healed by first intention. Ice applications had been employed. I transported him, during two hours, partly by coach, partly by rail. The vomiting soon ceased; the other symptoms continued. On March 21st patient had one temporary attack of diplopia; since then neither that nor diverging strabismus. But after the fever—highest evening temperature  $39.6^{\circ}$ —had subsided

\* Paper read before the Second International Otological Congress at Milan, September 7, 1880.

in two days, the cephalic pulse became more ominous: 48-42 beats; on the 25th, during an attack of violent pain in the *anus* and *forehead*, it even sank to 36, and up to date (April 3d) it has remained constant at 48. To-day, as on the first day, the watch is heard only when firmly pressed on; loud speech, in immediate proximity (possibly by means of the right, though plugged ear); *membrana tympani* intact. The left facial nerve is still paralyzed. Tinnitus in the left ear. Patient is otherwise perfectly well."\*

My advice as to therapeutics having been asked, I recommended, as soon as the fever should have permanently subsided, the internal exhibition of potassium iodide,† and galvanization of the acoustic nerve and of the muscles supplied by the left facial.

A second letter from his father, which the patient brought me on April 24th, contained the following:

"Parallel to the stab-wound, which has healed by first intention, about  $\frac{1}{2}$  cm. to the rear, we can feel a prominent osseous cicatrix. From April 9th to 12th, pulse 50 to 60; since then, 60 to 70. Potassium iodide since April 13th. The left facial nerve remained equally paretic from March 19th to date. From the 10th to the 16th Störer's magneto-electric rotation apparatus was employed daily. For the past two weeks, contraction of the right half of the face.

"Up to a week ago there was left-sided tinnitus of varying intensity, which has greatly moderated since then. At times the hearing seemed a little better, so that the watch could be heard when lightly applied (with the right ear?). On April 16th and since then he could not hear whispered speech, nor even through an ear trumpet.

"Heart-beat, pulse, etc., normal. Subjective condition good."

When I particularly inquired whether the disturbances in the region of the left facial and acoustic nerves had been observed *immediately* after the injury, the physician who had attended during the first fifteen hours gave the following information:

"I can make the favorable report that up to March 20th, 10 A.M., when I last saw the patient in presence of his father, no nervous paresis had occurred, excepting a certain impairment of

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\* Report of the father.

† During the first seven weeks after the injury 100 grammes were taken altogether.

hearing which, however, I interpreted more or less as a symptom of slow reaction in consequence of general cerebral stunning produced by the shock from the vigorous thrust, in connection with some inebriety."

On the other hand, on further inquiry, the patient's father expresses himself thus, under date of May 6th :

"I firmly believe in the *immediate* occurrence of the main symptoms. If I did not ascertain everything at once on *first* seeing my son, you will admit that here the father placed the physician in the background ; the more so as I did not know then that the point of the knife *had been wanting previous to the injury*."

"The impaired hearing certainly existed during the transportation to this place, for my son heard nothing at all when lying on his right ear. I distinctly remember that a change of the face struck me at first sight ; but I had not interpreted this fact immediately and clearly to myself as a paresis of the facial nerve."

*Status præsens*.—April 26th, 11 A.M. Complete paralysis of the facial nerve. A reddish scar, 13 mm. long, 3 mm. broad in its greatest diameter ; its anterior lower end is 6 cm. from the left outer canthus, and the same distance from the upper end of the left tragus. Beside and behind the place of injury, the above-described osseous cicatrix. The pupils are equal. Right nostril oval, larger than the left, which is more like a fissure. The upper and lower lips are drawn to the right. *Uvula* and *soft palate* normal in position. Salivary secretion normal. According to the measurements with the æsthesiometer, the sensibility of the left half of the face, when compared with the right, is rather increased. The points are perceived as double when 22 mm. apart, as single at shorter distances.

Test of the *sense of touch and taste* of the anterior two-thirds of the tongue. Sense of touch normal. The *sense of taste* appears lost on the left half of the tongue when tested with solutions of sugar, quinine, acetic acid, and salt. Sugar solution is perceived as water.

Of this disturbance the patient was hitherto unaware from his experience.

Result of the test of the *left organ of hearing* :

Tuning-forks in bone-conduction are perceived only on the healthy side, not on the left ; the same in air-conduction. This

is true also for acoumeter and watch. On plugging both ears, patient understands speech at a distance of  $\frac{1}{2}$  metre; at the same distance with the left ear open. *The power of hearing, therefore, is lost on the left side*; withal, there exists constantly a slight noise in the left ear, which, at first more occipital, has gradually approached the left ear, and has latterly increased in intensity.

The anterior wall of the auditory meatus, by its strong inward projection, hides the anterior half of the membrana tympani. Vivid injection of the vessels of the manubrium mallei. Through the normal posterior half of the membrana tympani, the long crus of the incus is perceptible. Pulse 84, temperature  $36.7^{\circ}$ . Patient had suffered from occasional constipation before the injury; otherwise healthy.

*Detailed Description of the Instrument with which the Injury was Inflicted.*

By my request, the instrument was sent to me for one day by the justice who tried the case.

Length of the knife-handle, 11 cm.

Length of the blade, 7.7 cm.

Breadth of the (broken) point, 4 mm.

Breadth of the blade at a distance of  $1\frac{1}{2}$  cm. from the point, 1 cm

Breadth of the blade farther toward the handle, 1.3 cm.

Breadth of the back of the knife at the point, 1 mm.

Breadth of the back of the knife in the middle, 2 mm.

Breadth of the back of the knife near the handle, 3 mm.

*Result of the Examination and Treatment with the Constant Current. Further Course of the Affection.*

The electro-muscular contractility in the region of the muscles supplied by the left facial nerve is nearly extinct. During the employment of the constant current, a subjective sensation of taste occurs. With twelve Siemens-Halske elements and external connection, a vivid ringing occurs on cathode closure, which persists a short time during the cathode duration, and returns with the anode opening.

CC = R'

CD = R

CO = O

An C = O

An D = O

An O = R



This formula proved constant in the course of many weeks, no matter whether the one electrode was on the tragus, and the other in the hand of the respective side, or the one on the tragus and the other on the left ala nasi or on the respective half of the forehead or face.\*

At all events, from the reaction of the auditory nerve to the electric current, the conclusion could be drawn that no absolute paralysis of it was present. The electric treatment of the auditory nerve afterward took place in the voltaic alternation, with gradual diminution in the anode; that of the muscles supplied by the left facial nerve, partly with stable, partly with unstable currents.

At first there was occasional frontal pain and repeated constipation; but the cerebral functions remained unimpaired, so that, with the exception of two days, patient could successfully pursue his customary studies.

*June 22d.*—After forty-four applications of the constant current, the paralysis of the facial nerve was still the same as on April 26th, as were the disturbances of taste in the anterior two-thirds of the tongue; solutions of sugar and quinine were not tasted at all, acetic acid as bitter, saline solutions as acid.

In regard to the organ of hearing, however, the following was noticed:

With ears free, *c* from the forehead is heard in the occiput; *c'* and *a*, on the right side; but when the left ear was plugged *a was heard on the left*, and the *other two on the right*. Whispered speech with both ears closed was repeated at a distance of 1 metre; *with right ear closed and left ear open, at 3 metres*. Obviously the left organ of hearing was recommencing to hear, and, moreover, in a very favorable manner; there was present, though still in an impaired degree, *bone-conduction for high tones*. This test was repeated on the following day with precisely the same result.

*June 25th.*—When both ears are closed, patient does not hear *a* and *c* at all by air-conduction, but he hears *c'* (obviously only on the right by transmission through the bones of the skull).

\* This forms a confirmation of Brenner's statement, who says: "*Concerning the distance of the two electrodes from each other*, I have already demonstrated (comp. 26th exper.) that a certain proximity of both renders the excitation of the auditory nerve impossible, because the coverings of the nerve, forming a secondary closure, prevent the current from acquiring a sufficient intensity. However, should the nerve be in a state of hyperæsthesia, then the electrodes can be brought much closer before a cessation of the reaction occurs. At times such a cessation cannot be obtained at all." (See "*Versuch zur Begründung einer rationellen Electro-Otiatrik*," Leipzig, 1868, p. 185.)

By bone-conduction (from the forehead), with left auditory meatus closed, he hears *all tuning-forks on the left side*; with both ears open, *c* in the occiput, *c'* and *a* on the right side. Hence there was present (though impaired) bone-conduction for deep tones likewise. By *air-conduction*, *a* is perceived now in front of the left ear; Politzer's acoumeter at a distance of 2 cm.

*From June 26th to July 9th, inclusive.*—Ten sittings. Interruption of the treatment on July 3d and 4th on account of violent frontal pain and incapacity for mental labor.

*July 5th.*—There appeared the first indications of a decided improvement in the electro-muscular contractility in the region of the paralyzed facial muscles. When requested to wrinkle the forehead, the folds extended farther beyond the median line than before; the left eye closed more perfectly; dropping of tears is rare; patient is able to whistle some.

*July 7th.*—Patient states that after closing his right ear he had heard his watch at a distance of one inch from the left ear.

*July 10th and 11th.*—Headache; forehead and vertex are the seat of a dull pain; there is also constipation. Remission after the use of bitter water.

*July 12th to 17th.*—Treatment with the constant current as before.

*Status on July 17th.*—Condition of the muscles supplied by the left facial nerve as in the first week of July. No improvement in the tasting capacity of the left half of the tongue.

Condition of the left auditory organ:

With both ears closed, speech heard at 5 metres.

" " whisper heard at 3 "

With right ear closed and left ear open, speech heard at 12 metres.

" " " whisper " 8 "

" " " acoumeter " 0.10 "

" " " tuning-fork *c* not heard.

" " " " *c'* heard at 0.06 metre.

" " " " *a'* " quite near.

Bone-conduction with ears free:

The above-named tuning-forks from the forehead are all perceived behind the right ear; when the left ear is closed, more toward the occiput.

*From July 19th to 28th.*—Treatment continued. Headache, frontal and parietal, on July 22d and 26th. Termination of treat-



ment by myself on July 28th. Thereafter it is to be continued at home by the patient's father.

Result of the *last* examination and test on July 29th :

The electro-muscular contractility of the paralyzed muscles has increased of late, inasmuch as the muscles of the mouth contract more strongly than formerly on electrical irritation. *The contrary obtains with all the muscles of the nose* which do not react at all to the electric current. That the muscular tonus of the left half of the face has improved may be recognized also from the increased fulness of the face ; it no longer appears so collapsed, the contraction of the right half of the face is much less conspicuous than before. The sense of taste on the anterior two-thirds of the left half of the tongue is still as before. Only acetic acid, after repeated tests, is perceived as "bitter ;" the other substances as indifferent.

*Condition of the organ of hearing : Bone-conduction*, when both ears are closed, *all tuning-forks heard on the right* ; the same when *right ear alone* is closed. This condition is *reversed* when the *left ear is closed*. *Acoumeter* : From the left temple heard very distinctly on the left side ; when the right ear is closed and the left open, at 0.17 metre.

Whispers, both ears closed, at 5 metres.

" left ear open, " 9 "

In reference to the localization of the source of the sound, some mistakes are still committed : six times in seven tests patient thought that the sound came from the right when it came from the left.

There is still some hyperæmia of the vessels of the manubrium mallei on the left side, and a continuous low tinnitus. The dropping of tears is changeable, sometimes present, sometimes not, never excessive.

In order to form an idea of the anatomical alterations provoked by the injury, and to make a more exact diagnosis in conformity therewith, the *settlement of a preliminary question was of importance* in the first place. Did the disturbance in the region of the left facial and auditory nerves *occur immediately or on the day following* the injury?

In this respect I have again entered into correspondence with the patient's father, and the latter, on his part, with the physician who had first attended. The result of these

inquiries, the details of which it would not be desirable to repeat in this place, has inclined me to the opinion *that the disturbances in the region of the facial and auditory nerves followed immediately after the injury*. I therefore do not hesitate to form a diagnosis of *fissure in the left petrous bone*. Possibly there were also circumscribed extravasations of blood in other parts, as in the region of the vagus and oculomotor nerves. To these may have been due the temporarily slowed pulse and the attack of diplopia. But it may be that the slow pulse was a consequence of the concussion accompanying the injury,\* and that the diplopia was due to a fissure of the orbit at the point of entrance of the oculomotor nerve.

If the disturbances in the region of the seventh and eighth cerebral nerves had really occurred as late as twelve to twenty-four hours after the injury, then their appearance could be capable of but a forced explanation, even taking into consideration the probable presence of an extravasation of blood.

According to the preceding detailed description, the point of injury was rather far in front, possibly at the suture of the squama of the temporal and the sphenoid bone; the instrument, which was broken previous to the stabbing, could not have penetrated into the brain substance proper;† at most it might have reached the dura mater at that point where there is no arterial blood-vessel of larger calibre. Should, however, the case have been by accident one of an anomaly—the existence of an abnormally large branch of the meningeal artery—and in consequence thereof a considerable hemorrhage have been possible, then, in order to effect the nerve-paralyses (of the facial and acoustic nerves), a descent of the blood as far as beneath the tentorium cerebelli must have taken place. That could not have been possible without some symptoms of cerebral compression, nor without a series of local and general disturbances, such as have been recently collected and described in the March

\* According to Dupuytren: "The slow pulse is not, by some authors, considered as characteristic of commotio cerebri." Vidal-Bardeleben, "Chirurgie."

† In that case, protracted fever, peripheric motor and sensory disturbances would not have been wanting.

and April (1880) numbers of the *Revue mensuelle* by Gérard Marchand, who gives a very full account of his own and other observations on disruption of the medial meningeal artery in injuries to the skull.

*These symptoms are:* Diffuse œdema in the temporo-parietal region; very intense pain on pressure on one spot; ecchymosis occurring some time after the injury, occasionally in the region of the mastoid process, sometimes in the zygomatic region; at times dilatation of the pupil on the injured side. Among the general symptoms Marchand emphasizes as the most constant—stertor. Ordinarily the patient is comatose, and early exhibits the symptoms either of cerebral irritation or of compression. Associated therewith are signs of contraction of muscles, relaxation, etc., in the most varied combination.

*Supposed Position of the Fissure.*

Taking into account the disturbances, after the injury, in the region of the facial and acoustic nerves, and the course of the affection, we may, in attempting to locate the fissure, particularly consider two places—namely, the porus acusticus internus or that region of the petrous bone which includes the first bend of the facial nerve and the osseous cochlear capsule contiguous to it.

If we assume a fissure in the region of the first bend of the facial nerve and the adjoining region of the cochlear capsule, together with an exudation or extravasation, we can explain the successive improvement of the hearing for tones, first for the higher, then for the lower ones, on the basis of Helmholtz's theory of tone-perception which teaches that the nerve fibres in the neighborhood of the fenestra rotunda serve for the perception of high, and those in the cupola of the cochlea for the perception of low tones. We may suppose that the exudation and extravasation in the neighborhood of the fenestra rotunda, a more deep-seated region, were less considerable, and for that reason absorption was easier and was completed earlier.

If we, on the other hand, make a diagnosis of fissure of

the porus acusticus internus, we could explain the just-described phenomena during the convalescence only by the assumption of *an isolated conduction in the auditory nerve*. Therefore, despite the copious transverse anastomoses of the nerve bundles situated between the plates of the lamina spiralis ossea, an isolated transmission of the single musical tones would have to take place as far as the musical centre of hearing. We would then be forced to imagine that an exudation or extravasation of blood, simultaneously effused with and through the fissure in the internal auditory meatus, at first caused the paralysis of both nerves, and that, in regard to the acoustic nerve, by the absorption during the course of the affection, those fibres which transmit the high musical tones were first set free.

I must confess that the former assumption is much more probable than the latter. It corresponds more nearly with surgical experience and the experiment concerning the relation of fissures to the point of attack. "Aran, Trélat, Masse and St. Pierre, as well as numerous other authors, have experimented in this sense and with the same result. Aran thus formulated the law, named after him, for the course of fissures produced in this manner: '*They commence at the point of injury and from there extend regularly on the shortest route to the base.*'" (See "Deutsche Chirurgie" by Billroth and Lücke. No. 30. By Prof. Dr. E. von Bergmann. "Die Lehre von den Kopfverletzungen," p. 193.)

If we take into consideration the point of attack in our case, the distance to the porus acusticus internus is certainly the greater, no matter which one of the well-known directions the fissure took in the middle cranial fossa—whether a transverse\* one or one parallel to the pyramid of the

\* In my collection (No. 70), there is a preparation of a *transverse fracture of the petrous bone* in a boy of 12. He was brought, five hours after a fall on his head—a distance of 16 feet—on July 12, 1862, to the Child's Hospital of this city, in a state of sopor. *There was no visible external injury*, and he remained soporose until the evening of July 18th. At the autopsy there was found: "Hemorrhage of the dura and pia maters. Capillary hemorrhages in the cortex cerebri. Fracture of the sphenoid bone, of the temporal squama, and of the petrous bone." On the *dry osseous preparation*, kindly presented to me subsequently by Prof. v. Dusch, is seen a complete separation of the pyramid. The fracture extends 3 mm. behind the quite intact porus acusticus internus, in a somewhat oblique direction, through the vestibule, the roof of which is partly

petrous bone.\* Moreover, the mass of bone to be separated by a fissure in the porus acusticus internus is a thicker (perhaps also denser?) one than in the first-named region. Finally, the assumption of an isolated transmission of single tones to the musical centre of hearing, in the described condition of the transverse anastomoses of the nerve fibres in the cochlea, is rather forced and lacks confirmation.

In reference to two cases of facial paralysis published by Erb as early as 1870,† we must make special mention of one circumstance. We have stated under the head of *status præsens*: "Uvula and soft palate normal." Erb, in one of his cases arising from trauma, besides the other symptoms of paralysis of the facial nerve, has observed also paralysis of the sense of taste and of the velum palati, and argues from the latter circumstance that the seat of the injury must have been above the place of origin of the petrosus superficialis major nerve, that is above the ganglion geniculi, because this nerve supplies the soft palate. If this argument were absolutely correct, we could certainly assume that in our case the seat of the fissure, leaving the cochlea aside, was between the ganglion geniculi and that section of the canalis facialis which extends above the stapedial region. However, the innervation of the velum palati by the petrosus superficialis major nerve is not quite certain. According to Henle ("Handbuch der Nervenlehre des Menschen." Braunschweig, 1871, p. 403), the anatomical investigations into the course of the fibres of the last-named nerve have led to contradictory results. Compare (*l. c.*) his quotations from Cloquet, Varrentrapp, Longet, Calori, Rauber, Beck, E. Bischoff. The observation of the oblique position of the uvula in unilateral paralysis, the cause of which lies in the central organ or in the temporal bone, according to him, indicates that the palatine muscles

forced off, through the fenestra ovalis, through the promontory, the fenestra rotunda, the floor of the tympanic cavity, through the middle of the jugular fossa. I am unable to present further details, but it is probable that the facial nerve and the soft parts of the vestibule were lacerated.

\* Concerning the direction of basis fractures in the medial cranial fossa, comp. v. Bergmann, *l. c.*, p. 195.

† *Deutsches Archiv f. klin. Med.*, Bd. vii.



receive their nerves *in part* from the facial, and moreover, as this supply is possible only by way of the geniculum of the last-named nerve, through the nervus petrosus superficialis, the nasal ganglion and the palatine nerves, the petrosus superficialis major nerve must contain motor fibres which extend from the ganglion geniculatum to the ganglion sphenopalat. "The direct experimental demonstration, however, has not been furnished with the certainty to be desired." Compare, *l. c.*, the respective quotations from Debrou, Valentin, Nuhn, Longet, Volkmann and Hein, which are in part contradictory to each other. In the case of Waschadka, which will shortly be published in these ARCHIVES, and in which, in consequence of caries of the petrous bone, paralysis of the facial nerve occurred several weeks before death, *there never was any paralysis of the uvula or of the soft palate, and yet the autopsy demonstrated that the facial nerve was totally destroyed from the ganglion geniculi centrally as far as the internal auditory meatus.*

Perhaps it may be possible to solve these apparently contradictory observations in a similar manner as those of the sense of taste. There, too, facts were present which tended to put in question the function of the branches of the facial nerve passing through the chorda to the lingual nerve as fibres which serve for the sense of taste in the anterior two-thirds of the tongue, until Schiff demonstrated (Moleschott's "Untersuchungen," Bd. x, pp. 406-422) that the lingual nerve has other fibres of taste which do not extend to the chorda—namely, nerve anastomoses between the second and third branches of the fifth nerve and the otic ganglion, which, in Schiff's opinion, contain, in different individuals, fibres of taste in varying number, so that sometimes one, sometimes the other of those connections forms the main conduction. Concerning our case, in particular, the lingual nerve of the injured side can have contained only such fibres of taste as belong to the facial nerve, and that alone. In this respect we refer to the above reports regarding the paralysis of taste in the anterior two-thirds of the tongue on the injured side, given in the history.

*Literature.*

In the second edition of the "Lehrbuch der Chirurgie," by Vidal-Bardeleben, Bd. iii, 1860, p. 61, we read: "Chassaignac, in his *thèse de concours*, has collected observations on injuries to the olfactory, optic, oculomotor, facial, auditory, glosso-pharyngeal, vagus, hypoglossus and other nerves."

This thesis (Des plaies de la tête, Paris, 1842) I have been unable to obtain either at the Heidelberg or Strassburg Library. I should have liked to inform myself whether combined paralysis of the facial and acoustic nerves, *in consequence of fissures* in injuries to the skull, are of frequent occurrence. In injuries of the skull with fractures of the basis cranii, paralysis of those two nerves is not very rare,\* and not infrequently such paralytic affections get well even after several years' duration. Thus Bruns† relates a case in which, after the lapse of three years, the paralysis of the facial nerve began to disappear gradually, seriatim from below upward, so that the eyelids could not be properly closed until the fourth year. Deafness, however, persisted. Assuredly Bruns is right when he says (*l. c.*, p. 329) that we must beware lest we refer every such paralytic symptom back to contusion or laceration of the respective nerve by a cranial fracture; because it might have been produced by various other factors, for instance, pressure by extravasations of blood within the cranial cavity, by lesion of their central termination at or within the cerebrum.

I refrain from further citations. Those who, by observations similar to the present, should be placed in the position

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\* Rather the most frequent of all cerebral nerves, generally by disruption; most frequently both are torn simultaneously, more rarely the facial nerve alone, and still more rarely the acoustic nerve alone. Bruns, *l. c.*, p. 329:

"In fractures of the base the paralysis of the facial nerve, either with or without coincident paralysis of the acoustic nerve, is the best-known nerve lesion, and is recognized already by the older writers as an important aid in diagnosis. In 24 fractures of the base of the cranium, Leisrink (*Langenbeck's Archiv*, Bd. xv, p. 55) has noticed paralysis of the facial nerve five times, and once of the facial and acoustic nerves. In 49 cases collected by Schwartz, there occurred paralysis of the facial nerve fourteen times, and the same number of paralyzes of the acoustic nerve. In five of these cases the paralysis affected both nerves together." Bergmann, *l. c.*, p. 404.

† "Handbuch der Chirurgie," Bd. i, p. 325.

of having to consult a more extensive compilation, can be cordially referred to the above-named treatises of v. Bruns and v. Bergmann; they present a rich material of personal and foreign observations, and furnish an equally ample and instructive synopsis of the contributions of authors who have made a specialty of the study of injuries to the skull.



## A CASE OF TREPANATION OF THE MASTOID PROCESS; DEATH BY MILIARY TUBER- CULOSIS.

By H. STEINBRÜGGE, OF HEIDELBERG.

Translated by WILLIAM C. AYRES, M.D.

*(With a curve of temperature. Table II.)*

H. S., a boy of five years had been suffering from an affection of his left ear since the fall of '79. Under the symptoms of an acute catarrh of the stomach, he began to complain of pain in the left ear, which three days later was followed by a discharge of pus, sometimes mixed with blood, but which, however, did not lead to any change in his general condition.

Prof. Moos was consulted for the first time on April 23, 1880. At that date the auricle stood out from the head; regio mastoidea normal and not sensitive on pressure; there were multiple polypi in the external canal. On April 29th many large and small tumors were removed with Wilde's snare, under chloroform narcosis, and the remains of the tumors which sprang in part from the tympanic cavity were treated with galvano-cautery. Between this and the fourth of May, necrosed granulations came from the ear spontaneously. On May 8th the left mastoid process was red, swollen, and excessively painful, the auricle standing out from the head more prominently than before. Painted with tincture of iodine. On May 11th an abscess formed on the posterior superior wall of the canal, and in the sanguino-purulent mass evacuated was a quantity of elastic tissue. The pain disappeared immediately after, but pus was still evacuated upon pressure. On June 24th the pain returned, the mastoid process was swollen, and Wilde's incision was made on July 1st under

chloroform narcosis. The knife sank easily into the decayed bone, and a solution of boracic acid which was injected into the canal flowed out through the wound, and a few days later it could also be forced through the wound into the canal. The subsequent course was satisfactory. Had a cough since July 12th. The fistula began to close in the beginning of August, and as the boy lived in the country he did not come for treatment for several weeks. He was afterward taken with a fever, and contracted a peritonitis.\*

On Sept. 11th I saw the boy for Prof. Moos. He had recovered from the above diseases, and did not complain of his ear, although the fistula had so far closed as to render it difficult to force the fluid from the meatus through the opening. On Sept. 24th the father came to me and informed me that his son had been suffering with chills, headache and vertigo since the 19th of the month. The chills seemed to originate in his head, and cold applications were disagreeable to him. He began to perspire, was restless and startled in his sleep, sleepy during the day, apathetic and taciturn, vomited, had a coated tongue, and was constipated. On Sept. 23d a passage was brought about by a soap suppository. His cough, which had disappeared for a time, returned.

As the symptoms were becoming alarming and an operation was under consideration, I requested Prof. Lossen to accompany me in my visit to the patient. On the evening of the same day we found him pale and lying drowsy in his bed. Pulse 64, small and intermittent; temperature  $37.2^{\circ}$ . Pupils wide, and reacting slowly to light. The vomiting had continued daily, and he constantly complained of headache. Since there was evidently a beginning cerebral complication, which demanded a free passage for the pus externally, we advised the parents to send the boy to Heidelberg for further treatment.

The following morning he was brought to the ear clinic, where we found that his condition was the same as that of the previous day. He had slept very restlessly, had vomited, and complained of a hammering sensation in his head. Pulse 70, temperature  $38.3^{\circ}$ , but there had been no return of the polypi. After chloroform narcosis I could pass a probe  $2\frac{1}{2}$  cm. into the fistula of the proc. mastoideus in the direction of the antrum, probably into

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\* The case is from the private practice of Prof. Moos who, being absent from the city, entrusted the patient to my care, and kindly permitted me to publish the case.

the cavity. A vertical incision was made under antiseptic precautions between the auricle and the former fistula down to the periosteum. The periosteum was dissected back on both sides, and the anterior wall of the fistula chiselled away, so that a sharp-edged spoon could be brought into the cavity and the bone cleanly scraped. On the injection of a 1-per-cent. solution of carbolic acid, the fluid could be passed both ways from the external canal through the wound, and *vice versa*. The wound was bandaged with carbolic and salicylic wadding.\* No collection of pus nor movable sequestrum was discovered.

*Two o'clock in the afternoon.*—The immediate effect of the operation was very good; probably on account of the bleeding; the boy spoke fluently, had a good appetite, and said that his headache had entirely disappeared. It returned, however, in the afternoon, and his pulse sank again; he drank often, and vomited three times. In the evening: Pulse 70, temp. 38.3°. Ordered ice-bags and suppositories.

*Sept 26th.*—He passed a quiet night, vomiting only twice. Pulse 64, temp. 37°. No evacuation of his bowels. Loss of appetite, coated tongue and dry lips. Belly soft and not sensitive to pressure nor drawn in. Bandage changed; syringing with 2-per-cent. solution of carbolic acid. Abundant urination; the color of the face alternated from pale to flushed. Ordered castor oil and ice bags. In the evening, passage produced by enema. Pulse 76, temp. 37°.

*Sept. 27th.*—Passed a good night. Pulse 70, temp. 36.8°. In the afternoon, 38.0°; evening, 37.2°. No decided change.

*Sept. 28th.*—Had chills during the night and passed his urine in bed. Headache. Ice bags refused. Ordered Seidlitz powder. Pulse 56, temp. 37°. Afternoon, 38.4°; evening, 38.2°. Groaned frequently and called continually for his father, although he was sitting on the side of the bed. Ordered calomel 0.12 grammes every two hours.

*Sept. 29th.*—In a drowsy condition. Defecated and urinated in bed. Drinks frequently; extremities cold; gnashes his teeth at times. Highest temp. 38.6°. Pulse intermittent, and in the evening, 96°.

*Sept. 30th.*—Pulse 116 temp. 38.2°. Eyeballs oscillating, especially the left; pupils dilated; twitching of the muscles of the right arm. The flexors of the left somewhat contracted; passed

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\* Prof. Lossen, of Heidelberg, and Dr. Werner, of Schwetzingen, kindly assisted me in the operation.

his stools in bed. Afternoon, pulse 120, temp. 39°. Face dark red. He eats ravenously, devouring large quantities of biscuits, but does not use his hands, taking them simply in his mouth. If he is not fed he bites at the wadding of the dressing, or chews the bed clothing. His power of vision seems diminished, but he evidently hears well. Ordered six leeches on his right mastoid process, and ice-bags. In the evening, pulse 128, temp. 38.2°. After the leeches, somewhat quieter, but only for a short time. Ordered bromide of potassium 1.0 grammes. Ice-bags. Neither the left ear nor the wound shows any peculiarity. The wound secreted but little, had a good aspect, the carbolic solution passing through easily. The dressing of carbolic lint and salicylic wadding continued.

*Oct. 1st.*—Pulse 144; small and weak. Highest temp. 39.2°. Very restless and screams frequently; gnashes his teeth; vision seems to be extinct. Ordered bromide of potassium 1.0 grms.

*Oct. 2d.*—Vomited frequently; both pupils dilated, but the left somewhat more than the right; nystagmus toward the left. On being pricked with a needle on his left side, the reflex motion was rapid, but on the right side slow. The right side seems to be generally paretic.

*Oct. 3d.\**—Comatose. Pulse 120, temp. 37°; evening, 38°. Face red; pupils oscillating. The contraction of the left arm passed off, and he could move it again, but only slightly. Ordered wine and black coffee, but as swallowing was very difficult he was nourished per rectum, but food was not well retained.

*Oct. 4th.*—Cheyne-Stokes' respiration. Pulse, 160; temp., 39.2°; with the exception of which he was in the same condition as before. Ordered subcutaneous injections of quinium sulphate. Passage produced by enema.

*Oct. 5th.*—Pulse, 160; temp., 38.6°; deep stupor; urine evacuated by using catheter.

*Oct. 6th.*—Pulse, 192, temp. 38.9°; evening, 37.6°; respiration varying Mucous râles. Subcutaneous injections of quinine.

*Oct. 7th.*—Pulse, 180, temp., 39.8°; cyanosis; evening, pulse, 184, temp., 39°; injections of quinine repeated; at 2 o'clock at night, *death*.

The *post-mortem* was made at 2 o'clock the next day, by Prof. J. Arnold. We were of opinion during the last weeks of treatment that the brain affection was not in direct connection with the

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\*Up to Oct. 3d he was treated by Prof. Lossen and myself, and later by us in connection with Prof. Moos.

lesion in the mastoid but was more probably tubercular basilar meningitis, which proved to be the case in the examination. Since the results of the *post-mortem* are interesting in many points we give the record unabridged :

Slight rigor. Epidermic surface of the skin white, subcutaneous adipose tissue scant, muscle system moderately developed, but of a light-red color. The skeleton was slender, but showed no decisive evidence of rachitis. Skull thick and compact ; sutures normal.

The dura thick and adherent at the convexity and basis over the points of the temporal bones. The pia of the hemispheres of the cerebrum slightly but diffusely cloudy, especially along the sinus longitud. Vessels strongly injected.

At the basis, the pia and arachnoid are dull and infiltrated with a yellowish purulent substance, and studded with numerous small white nodules. Both lateral ventricles considerably enlarged and filled with a slightly turbid serum. Ependyma moist, but not otherwise abnormal. The substance of the cerebrum and cerebellum soft, and injected with blood (especially the cortical portions), but besides showed no further change. Transparent serum in the cavities of the heart ; the pericardium normal, as also the endocardium and valves on both sides ; fluid blood and some coagula in the ventricles ; muscles of both ventricles of usual thickness, pale, but of normal consistency. The left pleural cavity contains turbid fluid. Both pleuræ of the left side show isolated miliary tubercles, and besides, that of the inferior lobe was uniformly opaque. The tissue of the superior lobe contains air, is moist, congested, and studded with miliary tubercles. At the anterior surface is a cheesy tubercle, the size of a cherry-stone. Accumulation of thick phlegm in the bronchial tubes, the mucous membrane being intensely red. The inferior lobe is more congested, softer, and contains less air, with the same changes in its tissue as in the superior. The same for the bronchial tubes. Bronchial glands enlarged and undergoing cheesy degeneration.

The right lung adherent over a great extent ; and the pleural covering intensely red and thickened, containing miliary tubercles, especially that of the inferior lobes. Tissue the same as on the left side.

Spleen adherent to the diaphragm, with miliary tubercles in its pseudo-membrane, capsule and parenchyma.

Left kidney small ; capsule adherent ; small cysts on its surface, and nodules in its tissue.

Right kidney enlarged, showing no shrinking on its surface, but otherwise in the same condition.

The mesenteric glands enlarged, and studded with small cheesy patches and nodules.

Liver enlarged and attached to the peritoneum by a pseudomembrane, in which there are small nodules as well as in the capsule.

*Anatomical diagnosis.*—Tubercular basilar meningitis following caries of the left temporal bone. Cheesy degeneration of the lymphatic glands ; miliary tuberculosis of the lungs, spleen, kidneys, liver, and serous membranes.

*Condition of the left temporal bone.*—Immediately behind the auricle, and about 4 mm. above the canal, we find the wound in the mastoid, which has become smaller by the formation of a membranous covering on its walls. The horizontal diameter of the entrance is 1 cm., the vertical 0.7 cm., whereas, somewhat deeper, the dimensions of the cavity which communicates with the middle ear are larger, on account of a small movable sequestrum which came away. The cavity showed nothing abnormal, and there was no scar to be found at the place where the abscess broke in May as recorded above. The drum-head completely destroyed ; the mucous membrane of the tympanum, and also its continuation into the mastoid cavity were thick and infiltrated with pus. The tympanic orifice and the bony wall of the Eustachian tube were broad, and covered with a yellowish muco-purulent deposit. The head and a part of the handle of the malleus preserved ; also the body of the incus was to be seen, while the crura were destroyed. The stapes remained in foramen ovale. The tubular communication with the mastoid cavity was irregular, and slightly bent, running parallel to the external canal. Its opening (already described) lay in a higher plane than the rest. The whole antrum mast. seemed to have been transformed into this opening. Nevertheless, the communication with the external canal was narrower than we would expect, on account of the smallness of the tympanic cavity and the thickness of its mucous membrane. Thus we see that the passage of fluids would entirely depend upon the condition of the mucous membrane, even where there has been an extensive trepanation.

The external surface of the bone was normal. *A direct trans-*



*mission of the morbid process to the brain could not be discovered in any part of the pyramid or of the dura mater in its vicinity.*

*Remarks.*

A glance at the history of the case will show that our suspicions of basilar meningitis were substantiated; but it was impossible to make this diagnosis in the beginning, since six days had elapsed before the case came under our observation. For instance, we could not determine whether the initial stage of fever was ushered in by chills, much less find out whether or not the temperature was high at the start, both of which being of great importance in making a differential diagnosis of encephalic processes of Colpitis cerebri, and diffuse meningitis (Wreden).\*

The first thermometrical examination excludes the possibility of the convexity-meningitis, since in this disease we have a continuous stage of fever with high temperature; and also phlebitis of the sinuses had to be excluded on account of the absence of chills and great variations in temperature. The accompanying curve shows that the increase was not great, nor were the oscillations in the same day. It also shows that at times there was even no fever, which, according to Wunderlich, is often observed in granular basilar meningitis. Since the temperature and the pulse increased together during the last days of the patient, and even the former went higher than the latter (not lower than is the rule), we can possibly conclude that the complication of miliary tuberculosis in the lungs and abdominal organs only made its appearance in the later stages of the disease. There is also a very rare relation of temperature, which, if it be substantiated by further observation, will be of great importance in differential diagnosis, viz.: the curve shows that, from the first to the fourth day (reckoned from the day of operation), and also on the sixth and eighth days, the temperature, which was measured at two o'clock in the afternoon, was higher than it was in the morning or evening.

\* Compare ARCHIV. OPHTHAL. AND OTOL., iv, p. 52, and v, p. 75. Sudden and rapid elevations to high temperatures, without chills, according to Wreden, are diagnostic of encephalic diseases.

Since I have noticed these variations from the usual evening exacerbations, with more or less regularity, it may be that by carefully observing the temperature in the initial stages we may gain some important points in the diagnosis of "granular basilar meningitis."

Notwithstanding the fact that observations in the beginning of the disease are wanting, on account of the low temperature we could have been led to suspect the formation of an abscess in the brain, had not other symptoms led to the diagnosis of basilar meningitis.

The slowness and a rhythmical beat of the pulse pointed to an increase in the intracranial pressure; toward the end, however, the irregular and constantly-increasing pulse showed the characteristics of hydrocephalus in children, viz., the frequent and rapid changes in the number of beats. The change in the color of the face, which was sometimes observed only on one side, was evidently the result of irritation of the sympathetic system.

The disturbance of motility was confined to one group of muscles of the upper extremity, demonstrating itself by twitching in the flexors; but at a later stage these muscles were more paretic, and those of the other side also began to be affected. Besides these, clonic contractions of the muscles of the eyes were noticed, and the same in the pterygoid muscles, producing the gnashing of the teeth, symptoms so frequent in hydrocephalus in children.

The first-mentioned condition of the right extremity was probably brought about by hyperæmia and serous effusion into the cortical substance of the brain, and especially in the superior two-thirds of the left anterior central convolution (H. de Boyer).

This supposition is supported by the affection of several groups of muscles, the transient condition of the tonic spasms, the convulsions and the paresis, and lastly, by the absence of any lesion in the large cerebral ganglia and the capsule, from which the disturbance of motility might have resulted. Except his headache, we could not make out any sensitive disturbance, since the early appearance of coma made such observations impossible.

Of the organs of special sense, the eye was the most affected, and probably by a transmission of inflammatory processes within the sheaths of the optic nerve, and during the last four days the boy was undoubtedly blind. The dilatation of the pupils before disturbance of vision set in, and the irregularity in their sizes at a later stage are hardly to be explained, as it is not probable that there could have been an alternate paresis and irritation of the oculomotory and sympathetic; but the symptom of oscillations of the pupils, which is so often observed in hydrocephalus in children, was well marked.

As regards the other organs of special sense, the functions of the ear, at least on the right side, seemed to have been preserved until the beginning of coma. A comparison between the conditions of the two ears was impossible, on account of the refractory conduct of the patient. The sense of taste remained unchanged for a long time, and the body reacted energetically to all the medicines administered.

The organs of respiration showed no anomaly during the first weeks of the disease, except an occasional fit of coughing and vomiting which was looked upon as whooping cough. The frequency of respiration only set in during the last days, when its number amounted to 30-40 per minute, but, similar to the beat of the pulse, was liable to a rapid and frequent change. Two days before death the respiratory sounds at the base of the lungs were very weak, without any dulness on percussion; but in the superior portion there were moist râles, a condition which seems to indicate that the tuberculosis had appeared in the lungs and pleuræ only in the last days. The increase in respiration can be attributed to the miliary eruption, whereas the frequent change and arhythmic condition are pathognomonic of tubercular basilar meningitis in children.

The digestive organs showed their usual complications in brain troubles, viz.: loss of appetite, vomiting and constipation; and the ravenous appetite, which lasted only a short time, can be attributed to irritation of the vagus. The tongue and lips were both moist, at least so long as the sensorium was free. The absence of the boat-shaped belly is

against the diagnosis of acute hydrocephalus, but it is possible that this symptom is often wanting. Nevertheless, the fact that the belly remained soft and insensitive to pressure, is further proof that the miliary tuberculosis in the abdominal organs was also of late appearance.

As is frequently the case in private practice, we could not get pure specimens of urine for examination in the earlier part of the disease, and later it was passed in bed, and that which was drawn off by means of the catheter, was dark, had a heavy sediment, but contained no albumen. The enuresis, as well as the final incontinence of urine, were not sufficient to designate a definite lesion of the kidneys.

As far as the therapeutics of the case are concerned, it need hardly be mentioned that the operation would not have been undertaken, had we been able to make an early diagnosis of basilar meningitis independent of the disease in the temporal bone, but under the conviction that there was a retention of pus within the mastoid cavity, and with the hope that it was still possible to check the progress of the disease toward the brain, we considered the trepanation of the mastoid as absolutely necessary, and we believe that in all such cases the same course of treatment is indicated; nevertheless, we see again, in this case, how many unhappy complications are liable to occur in the opening of the mastoid antrum.

Again, we may ask whether the tuberculosis was the result of infection from the mastoid disease,\* and if an early operation, that is, as soon as a narrowing of the fistulous opening could be determined, or before the brain had been complicated, could have saved the life of the patient. Supporters of an early trepanation will certainly take this view, but, on the other hand, it is impossible to say that other caseous nodules, such as the enormously enlarged and degenerated bronchial glands, had not made their appearance before the mastoid disease set in; in fact, whether the whole condition of the middle-ear affection was not caused by a tuberculous diathesis, or at least that this diathesis was an

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\* An opinion of Buhl, which is, however, denied by Colmheim, in his latest article on "Tuberculosis from the Standpoint of Infection," Leipzig, 1879.

obstacle to the cure of the ear disease after it had once commenced. The parents of the child are healthy, as also his brothers and sisters, even the boy himself is said to have been well up to the beginning of his ear trouble; but, on the other hand, we learn that the grandfather, on the father's side, although to-day a strong old man, was sick for a long time, and was looked upon as a consumptive. He had ten children; and four daughters (aunts of our patient) died of tuberculosis. We therefore see that the family is tuberculous, and it is possible that the disease of the ear, the cough and peritonitis, may have hastened the maturity of the tuberculosis, notwithstanding the fact that the boy had always lived in the country, was well nourished, and his general health apparently was as good as could be desired.

When under such favorable conditions the fistulous opening in the proc. mastoid. commences to close, the running has stopped, and there is no pain in the ear, a reasonable hope may be entertained that the disease is tending toward a cure, and the surgeon, as also the parents, will not be inclined to subject the patient to the dangers of an important operation. Indeed, such an operation is useless, if, as in our case, we do not find a cheesy retention, and, if there be already an existing dyscrasia, may be absolutely harmful, on account of the accompanying excitement, the loss of blood, and the danger of wound-fever to which it exposes the patient.

PYÆMIA FOLLOWING A MASTOID ABSCESS.  
TREATED WITHOUT MEDICINE. RE-  
COVERY.

By EDWARD T. ELY, M.D., NEW YORK.

THE importance of clinical observations bearing upon the condition known as *pyæmia*, and the rarity of recovery when severe manifestations of that condition have appeared, are my reasons for publishing the following case :

Louis S., aged 15, has had chronic suppuration of both middle ears for many years. During the past year he has been treated in the clinic of Dr. Roosa and myself at the Manhattan Eye and Ear Hospital, and nothing unusual has been observed about his case until lately. On the afternoon of Jan. 20th he was brought to me with well-marked mastoid periostitis on the right side. The cause of this inflammation was not evident. The redness, tenderness and swelling were confined chiefly to the anterior two-thirds of the mastoid process, and the swelling was not very great. There was severe pain in that side of the head, and marked constitutional disturbance. An immediate operation was advised, but was declined by the family. The boy was taken into the hospital, however, and four leeches were applied. When seen by me at half past eight the next morning, he was decidedly worse. There was high fever—a temperature of  $104\frac{1}{2}^{\circ}$ —and great pain in the right side of the head. With the assistance of the house-surgeon, Dr. Cox, I made a Wilde's incision, but found no pus. The bone exposed by the incision seemed sound ; but after considerable burrowing under the anterior flap of the wound, I detected a softened spot in the bone through which a stiff probe



was gradually worked into the mastoid cells, and a small quantity of thick pus then escaped. After the fistula had been enlarged, a tent was inserted, a poultice applied, and the hot douche ordered to be used every two hours. The operation was performed under ether. The bad symptoms were immediately relieved. At 1 P.M. the temperature was  $101\frac{1}{2}^{\circ}$ , and it fell rapidly to the normal. The mastoid tenderness and swelling subsided. The patient seemed to be making a speedy recovery, and I considered him out of danger. The wound was syringed with carbolyzed water and the tent changed twice a day; and the ear was douched frequently with hot water. Excepting that some pain persisted in the frontal and right temporal regions, there appeared to be a progressive improvement in all respects until Jan. 27th. Early in the morning of that day he suddenly had a chill, and the temperature at 9 A.M. was  $104\frac{1}{2}^{\circ}$ . He complained of pains in various parts of the body, especially in the left knee joint, the throat, and along the right external jugular vein. All these points were very tender, particularly the track of the vein, but there was no external redness or swelling. The discharge from the wound became less. Between this date and February 8th he presented well-marked symptoms of *pyæmia*. He had irregular chills and sweats, and a temperature varying irregularly between  $99\frac{1}{4}^{\circ}$  and  $105^{\circ}$ . His tongue at first was brown and dry, and then became very red, dry and glazed. There was great prostration, a rapid pulse, and a dusky pallor of the skin. There was marked increase of the previous deafness on both sides. He was restless at night, and may have had slight delirium, judging from the account of his friends who sat with him; but no delirium was observed by any of his medical attendants. His pupils always appeared normal. He had some cough and complained of pains in his chest but I could find nothing abnormal by physical examination. Several copious clay-colored stools occurred. His general condition was so alarming that I thought he would surely die; and this was the opinion also of Dr. Roosa, who saw him frequently in consultation with me. An unfavorable prognosis was given to the family.

Additional features of his sickness may be gathered from the following somewhat incomplete notes, which I made from time to time:

*January 28th.*—Pains the same as yesterday. Pains also in right axilla, along the inner edge of the right biceps muscle and in the right knee. All these points very tender.

*January 29th.*—Discharge from the wound more abundant, of dark-brown color, and fetid. [This continued for five days.] Pains the same.

*January 31st.*—Pains and tenderness along each clavicle. A red and tender swelling about the size of a walnut has appeared over the left sterno-clavicular articulation; distinct sense of fluctuation.

*February 2d.*—Pains and tenderness along clavicles, shoulders and arms. Less tenderness along jugular vein.

*February 5th.*—Red and painful swellings, apparently glandular, in the neck, below mastoid, right side. [Deep suppuration occurred in the tissues of the neck subsequently, and the pus was evacuated through the mastoid opening.]

*February 12th.*—Swelling over clavicle gone. [All who examined this swelling had diagnosticated fluid contents, but no incision was made into it.] Opened an abscess in the gum over the second molar tooth, right upper jaw, and evacuated considerable pus. The whole right side of the face was flushed, swollen and tender. A probe in the incision passed about  $1\frac{1}{2}$  inches upward over the exterior of the bone. Patient sits up for the first time.

There were no unfavorable symptoms after this date. The convalescence was slow, and the patient was not strong enough to leave his room until February 20th. He went out February 26th. At that time there was a free discharge from the mastoid fistula and from the ear, and the hearing was  $\frac{c}{40}$ .

Below is a partial record of the temperature:

*January 21st.*—9 A.M.,  $104\frac{1}{2}^{\circ}$ ; 1 P.M.,  $101\frac{1}{2}^{\circ}$ ; 7 P.M.,  $101\frac{1}{2}^{\circ}$ .

“ 22d.—9 A.M.,  $101^{\circ}$ ; 7 P.M.,  $101^{\circ}$ .

“ 23d.—9 A.M.,  $100^{\circ}$ ; 7 P.M.,  $99\frac{1}{2}^{\circ}$ .

“ 24th.—9 A.M.,  $99^{\circ}$ ; 7 P.M.,  $99^{\circ}$ .

“ 25th.—9 A.M.,  $98\frac{1}{2}^{\circ}$ ; 7 P.M.,  $98\frac{1}{2}^{\circ}$ .

“ 26th.—9 A.M.,  $99^{\circ}$ ; 7 P.M.,  $98\frac{1}{2}^{\circ}$ .

“ 27th.—9 A.M.,  $104\frac{1}{2}^{\circ}$ ; 7 P.M.,  $101\frac{1}{2}^{\circ}$ .

“ 28th.—9 A.M.,  $104^{\circ}$ ; 12 noon,  $104\frac{1}{2}^{\circ}$ ; 7 P.M.,  $103\frac{1}{2}^{\circ}$ .

“ 29th.—9 A.M.,  $104\frac{1}{2}^{\circ}$ ; 12 noon,  $105^{\circ}$ ; 10 P.M.,  $103\frac{3}{4}^{\circ}$ .

“ 30th.—9 A.M.,  $100\frac{1}{4}^{\circ}$ ; 2 P.M.,  $103^{\circ}$ .

“ 31st.—9 A.M.,  $100^{\circ}$ ; 10 P.M.,  $99\frac{1}{2}^{\circ}$ .

*From February 1st to February 8th.*—The temperature varied between  $99^{\circ}$  and  $101^{\circ}$ .

This case is interesting not only on account of its fortunate termination, but because it serves to illustrate the nat-

ural course of the disease in question ; for, throughout his illness, the patient took no drugs whatever. This plan of treatment was adopted at the outset from my conviction that no drug would arrest the septic poisoning, and that the large doses of quinine often used were capable of doing harm. This view was shared by Dr. Roosa in all my interviews with him ; but it evidently excited wonder in the minds of some of the medical visitors who happened to be attending the clinics at the time. This very common feeling of surprise at seeing any alarming sickness treated without the use of what is by so many considered essential, shows that many minds can profit by the study of just such a narrative as has been given above.

Aside from the matter of drugs, this boy, of course, had a great deal of medical treatment, in the best sense of the words. He had a quiet room to himself with an open fire ; some member of his family sat with him each night, and he had the efficient nursing made possible through the kind supervision of Dr. Cox, as well as the latter's constant medical observation. I visited him often myself, and every small detail regarding food, stimulants, dressings, etc., received thoughtful consideration. Fortunately, food was well borne during the entire period. The diet consisted of milk, to which was added a little sherry wine at first, and afterward a little whiskey. Poultices were kept applied over the jugular vein and upon the painful swelling over the left sterno-clavicular joint. The free action of the bowels was doubtless useful in eliminating the poison, as has been remarked of other similar cases. Might not large doses of quinine (through their astringent action) have tended to check these desirable movements of the bowels, in addition to the depressing effect they might have had upon the nervous system ?

As soon as the crisis of this boy's illness had passed, the improvement in the expression of his face and in his whole aspect was so striking, that it would naturally have been attributed to any medicine that he might have been taking at the time. Still more natural would such an inference have been regarding the rapid disappearance of the abscess—for such I believe it was—over the clavicle.

Another interesting point is that the sanitary condition of our hospital is considered unusually bad just at present.

I would not have these remarks understood as an argument that pyæmia is better treated without drugs, or that, by withholding drugs, a life has here been saved. There is, of course, no proof that this patient's recovery was due to anything that we did for him, although I cannot help feeling that his chances were improved by his hospital care. His history is made public in the hope that it may prove instructive as well as interesting to some who may read it.

## ON A PECULIAR EXOSTOSIS IN THE EAR.

By A. HEDINGER, M.D., OF STUTTGART.

Translated by ISIDOR FURST, of New York.

(*With plate ii, figs. 1-3.*)

THE chapter of the exostoses is still rather dark. Their pathogenesis is as yet entirely unknown, and scarcely rises above the level of hypotheses. I intend, therefore, to present in the following pages a picture differing from the ordinary exostosis, because the microscopic examination of the parts removed by operation offered surprising information regarding their origin, prognosis and treatment.

In respect to the etiology in general, I must, with almost absolute certainty, in about 40 cases which I have observed in the last few years, exclude syphilis which is given by Toynbee and v. Tröltsch as a prevalent cause, and also the abuse of alcoholic liquors. I rather incline to the view of the younger Delstanche who, in his "*Contribution à l'étude des tumeurs osseuses du conduit auditif externe*," finds the cause in a chronic inflammation of the walls of the external auditory meatus, which is either isolated or combined with similar affections of the middle ear. I can also concur with him in this, that frequently some other disease of the organ of hearing accompanies the new-formation, such as chronic tubal catarrh or suppuration. In the case to be detailed now, it is evident that the tumor was a consecutive one, and arose in the course of an inflammation of the mucous membranes of the middle ear.

The patient, a switchman, otherwise healthy and formerly with good hearing, had suffered for the past eighteen months from otorrhœa on the right side, without known cause, until violent pain now forced him to consult a physician. The latter found diffuse swelling of the parts around the ear, and a moderate rise in temperature. The hearing was almost gone, as was bone-conduction. In the right meatus he found a new-formation which the patient stated had arisen since the suppuration commenced; it occluded the meatus completely, was immovable, and of bony hardness to the probe. No pus, no fluctuation anywhere, rather high fever. In the succeeding few days the condition remained stationary. Two weeks later, however, on pressure upon the portion of the ear-canal adjoining the new-formation inferiorly, two tablespoonfuls of thick, creamy pus were evacuated, and during the succeeding probing it appeared to the physician as if he were encountering rough bone at the lower surface of the tumor. The next few days, there was a remission of the fever and great subjective relief, especially when pus was evacuated by pressure.

The treatment consisted in irrigations with carbolic acid and painting with tincture of iodine.

Soon after this the patient came under my treatment. The first thing that struck me was the great injection and swelling of the mastoid process and its surroundings, as well as the pathognomonic forward and outward displacement of the auricle; no fluctuation could be recognized on pressure. The meatus was filled with a hemispherical, immovable new-formation of osseous consistence, starting from the upper and posterior wall of the auditory meatus (comp. the illustration, plate ii, fig. 2, *A*). Below and between it and the anterior wall, the probe could be inserted to the depth of 2 *cm.*, where some rough bone was felt. At the same time, there was a copious evacuation of pus which increased still more on pressure upon the auricle. Very annoying and painful tension of the skin. Hearing distance and bone-conduction = 0, tube free, with loud perforation whistle and rattling.

The treatment consisted in irrigations, twice daily, of potassium hypermanganate, and application of cataplasms behind the ear. After a few days, I made a very long Wilde's incision, and evacuated at the same time several tablespoonfuls of thick, healthy pus. The probe could be inserted deeply in the new



opening inward and above in the direction of the external auditory meatus. The water used in the dressing also flowed in the same direction, as soon as it emerged from a fistulous tract extending from the floor of the meatus obliquely toward the retromaxillary fossa, where it opened. The tumor at the mastoid process collapsed rapidly. In order to obtain an idea of its hardness, a test puncture was then made with the electrolytic needle. The needle entered with some difficulty. But before I decided upon an operative procedure, I made another attempt with laminaria which had a surprising effect. It was evident, indeed, that by a daily introduction of laminaria the swelling became visibly smaller and was crowded toward the posterior and upper walls of the auditory meatus, while the lumen of the external ear-canal grew wider and wider. A single intermission of the introduction of the laminaria\* was followed by an immediate enlargement of the neoplasm as early as the next day. Once a square-shaped necrosed piece, 8 mm. by 4 mm., was withdrawn from the lower wall of the auditory meatus. With the renewed employment of the laminaria the ear-canal again widened considerably, apparently exceeding its normal calibre. Its covering assumed the appearance of a tissue in a state of callous degeneration, together with granulations secreting pus abundantly. The same tissue also formed the background of the meatus.

The membrana tympani was entirely degenerated, or rather, had a large defect in consequence of the ulceration. At the lower wall of the meatus several fistulous openings could be demonstrated from which the water injected through the incision welled up in a body. At the place where the neoplasm adhered to the meatus, *i. e.*, at the upper wall, the probe discovered a slight depression in the bone, filled with caseous pus.

After the cessation of the stagnation of pus, an operation was not essential; besides, I desired to await the further effect of the laminaria, which, of course, had its limit. I therefore did not divide the cords bordering on the anterior fistulous tract until I saw that it was of no further use. I then applied the chisel to the before-mentioned depression, in order to enlarge it. In this way I laid bare a cavity the size of the antrum mastoideum, but I abstained from a further enlargement of the opening, as it contained no noteworthy quantity of pus. But I applied the chisel to the lower third of the tumor, and removed numerous particles

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\* He prepared the laminaria tents himself from the root of the plant.

in this manner, amounting in all to about a piece the size of a pea. A dense fibrous tissue closely enveloped the osseous nucleus and was connected with its surroundings by cords. The chiselling was easy, and I should have looked upon a galvanocaustic operation, in this case, as decidedly unjustified. There was no inflammatory reaction, and therefore several other smaller pieces were removed on the following days from the place of the first operation. Now that the pus, which, as was clearly shown, issued from the drum-cavity, had free egress, the question arose, whether the tumor should be completely removed in the above-described manner, and whether it should be done at once. As I expected to obtain information in several respects from the microscopic examination, and as haste was not indicated, several preparations were made from the removed mass, as follows:

*A section through the periphery* (see plate ii). The papillæ are proliferating, of different lengths, and divided in many ways, and epithelial cones are between them. At the periphery they approach the normal. Toward the centre, however, bone-substance may be seen in the shape of osteoid tissue, that is to say, the new-formation of bone at that place does not proceed in connection with other bones, but as ossification of the connective tissue in isolated patches; the calcification extends high up on the papillary body.

*A second section* (see plate ii), under low magnifying power, shows a strange proliferation of the cells in the tissue of the cutis, besides the enlargement of the papillæ. The cells represent the final products of an inflammatory irritation of the connective tissue, *i. e.*, a large increase of connective-tissue corpuscles. Under high power, and after staining with hæmatoxylin, we also observe pus cells in the epithelium, and an effusion of blood under a vesicular detachment of the epidermis. The same condition is shown by sections of the exostosis decalcified by chromic acid. Therefore, the diagnosis is made of *inflammatory proliferation of the papillæ and of the connective tissue, with deposition of lime within it (osteoid metamorphosis)*.

As there was present no new-formation of bone, such as is generally observed in exostoses, but rather an inflammatory

process which, of course, was combined with osteoid metamorphosis of the proliferating connective tissue, thereby acquiring the character of a true exostosis, I had to ask myself the question whether the complete removal of the neoplasm was of value at the present moment; whether the transformation of the connective tissue was not rather continually renewed as long as inflammatory symptoms, which possibly might extend toward the brain, were present. I therefore decided to wait, and simply ordered astringents, together with oft-repeated cleansing with salicylated water and continued insertion of laminaria.

Gradually the fistulous tracts closed, and the suppuration became less. Despite all this, however, new granulations sprang from the wound of operation; they were only less firm to the touch. The defect at the mastoid antrum closed completely.

At this time the patient, who had been under treatment about six weeks, was obliged to resume his duties, and I could not re-examine him until after some weeks—a period I awaited with great interest, as I thought to be able to determine the necessity of a further operation from the condition of the new granulations. If they still seemed to consist to the naked eye of succulent connective tissue, I thought it would be better to undertake the final removal of the tumor after the disappearance of all inflammatory symptoms, in case the patient still insisted upon it; because, in the absence of bone-conduction and of any hearing power, I was forced to assume an obliteration of the middle and inner ears—a condition which, fortunately for the patient, was not substantiated later.

To this end I removed many granulations and particles of bone with the sharp spoon. The probe could be inserted to the depth of 4 *cm.* Granulations were present throughout the auditory meatus, with slight suppuration. The new formation had not enlarged. The proliferations at its lower surface were quite distinct from the harder tissue situated more deeply. At its posterior aspect rough bone could be felt.

The microscopic examination of the removed masses showed pretty nearly the same tissue, only the cell proliferation in the cutis was less copious. The new-formed osteoid tissue was likewise present in smaller quantity than at first. I could, therefore, conclude that the inflammatory process was abating. A like condition,

but increased in degree, was observed several months later, after the same treatment as before (laminaria and salicylic acid). The suppuration diminished steadily; the walls of the meatus, formerly covered with granulations, became invested with normal tissue. The membrana tympani, in the place of which only ulcerating tissue could formerly be seen, again became visible, having a paler color; an oval perforation was in its lower portion close to the meatus. Bone-conduction was restored. Hearing distance for a watch with a pitch and an intensity of Politzer's acoumeter, 5 *cm*. New-formation stationary. After two months more, the suppuration had disappeared. From that time I did not see the patient for six months, during which time he was engaged as a switchman at a rather elevated station (about 400 metres), without any disturbance in his condition during the past severe winter, and without applying anything. When he again presented himself, some weeks ago, the following condition was noted:

No suppuration. The surface of the tumor was covered with a smooth, pale membrane; it still filled half the lumen of the meatus; behind it the coverings appeared normal and were limited by the smooth, glistening, cicatricially regenerated membrana tympani with a concave opening in the lower part, almost the size of a pea, through which the mucous membrane of the promontory, showing the same color and condition, could be clearly recognized. See plate ii, fig. 2, *B*.

Bone-conduction distinct, though not as yet of normal strength. Hearing distance 30 *cm*.

Thus the question which I had originally asked myself, whether a complete removal of the tumor was indicated, had been answered in the negative, because after removal of a portion of it, there ensued a cessation of the inflammatory symptoms (suppuration, etc.) which had been increased by the occlusion of the ear-canal. From that time the tumor remained stationary, no longer hindering the patient in the discharge of his duties. He was well satisfied with the result. By careless removal of the entire neoplasm, an unnecessary danger would have been incurred—that of extension of the inflammation to the mastoid process and the meninges. At present a removal of the remainder of the tumor—which, by-the-by, the patient himself does not desire—would not be justifiable.

It would only be indicated if the tumor should grow, of which, however, there are no symptoms present. By the aid of the microscope, inflammation was demonstrated as the pathogenesis of a neoplasm, and accordingly furnished a clue to the treatment to be instituted. The effect of laminaria upon such a comparatively large and firm tumor is at any rate not without interest and but rarely recorded in literature.

## ANATOMO-PATHOLOGICAL CONDITIONS IN A CASE OF MALFORMATION OF THE RIGHT EAR.

BY S. MOOS AND H. STEINBRÜGGE, OF HEIDELBERG.

Translated by ISIDOR FURST, of New York.

WE are indebted to Dr. Emil Bloch, of Graben, for the opportunity to make the following examination, and for the history appended.

On the 11th of May of this year, the married couple F. H. showed me their first-born child Louisa, two days old, on account of a defective development of the right auricle. The parents are healthy and well formed throughout.

The right auricle, indeed, was misshapen in a high degree; only the lobule could be distinguished with some accuracy, while the upper half of the pinna was folded over the lower one, so that the whole, at some distance, bore some resemblance to a cauliflower excrescence. On attempting to expand the parts with the fingers, the cartilage, by its elasticity, immediately returned to its former position. No trace could be discovered of the external auditory meatus; one or two quite shallow depressions took the place of the furrows and grooves of the normal auricle.

Moreover, this rudimentary piece did not occupy its ordinary position, but was situated more to the front and below, upon the ascending ramus of the inferior maxilla; the latter, and indeed the entire right half of the lower jaw, was less strongly developed than on the left, being narrower, less prominent, the arch shallower, so that the lower half of the right cheek, as compared with the left, was considerably flatter, and the child's face exhibited a peculiar distortion. The vault of the cranium showed no abnormal formation.



On May 17th, general convulsions with cyanosis occurred, to which the child succumbed on the 20th, the eleventh day of her life.

The rudimentary right auricle, when expanded, measured in length 1.8 *cm.*

The left, normal one, 3.5 *cm.*

The right inferior maxilla, from the middle of the chin to the angle, 4.5 *cm.*

The left, normal one, 6.5 *cm.*

Besides, the symphysis of the inferior maxilla was displaced to the right rather more than half a centimetre.

The distance from the septum narium to the condyle of the lower jaw measured, *Right*, 6.3 *cm.*, *Left*, 8.0 *cm.*

I was unable to find a trace of the external auditory meatus in the soft parts; the condition of the Eustachian tubes was not examined.

The cerebral meninges were very full of blood. The œdematous brain *dissolved* when taken from the skull. At the base of the skull I could see no abnormality, in particular no difference between the right and left temporal pyramids.

For fear of spoiling the specimen, I did not dare to investigate whether there was any malformation in the deeper parts of the ear.

The case vividly recalls the one of "Asyntrophy of the right Temporal Bone," reported by G. Brown.\* There, too, the auricle was defective, the lower maxilla unsymmetrically developed, and the cheek flattened. Only, in the present case, I am unable to refer the malformation to the temporal bone and the faulty position of the glenoid fossa. They might rather, in this instance, be referred, as by Virchow,† to early disturbances in the growth and development of the first branchial fissure and the first branchial arch, from which latter, besides the lower jaw, the malleus and incus are also formed. Inasmuch as in my case we have to deal with a faulty development of the right lower jaw, a like state might also prevail with the two ossicles named. I therefore take the liberty of forwarding to the editors, together with these memoranda,

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\* These ARCHIVES, vol. ix, No. 2, pp. 168 and 169.

† *Virch. Arch.*, Bd. xxx, p. 222.

the excised right temporal pyramid preserved in spirit of wine for further examination.

*Condition of the Petrous Bone.*

The petroso-squamous fissure is 1 cm. long ; the jugular fossa is club-shaped, very shallow ; its broadest part measures 3 mm., its narrowest part  $1\frac{1}{2}$  mm. The carotic canal, where it enters the petrous bone, has a diameter of 2 mm. ; at its apex, and in the middle of the canal, 4 mm. The styloid process and the cartilage of the Eustachian tube are absent. The canalis facialis, together with the stylo-mastoid foramen, shows an osseous obliteration up to a distance of some millimetres peripherally from the hiatus canalis Fallopii. In the region of the stylo-mastoid foramen there is a small triangular piece of cartilage, probably an indication of the styloid process.

The external auditory canal, excepting a small triangular space, is obliterated. The base of this space, directed backward, is 1 mm. long, the sides,  $\frac{1}{2}$  mm. An osseous bridge, 2 mm. broad, separates the space just described from a cavity about twice that size, situated in the region of the drum, likewise of a triangular configuration with the base behind and above, and the point in front and below. At the medial wall of this small space are the two labyrinthine fenestræ,—a small opening of the diameter of thin metal wire which can be passed through it into the first cochlear convolution ; and another one situated behind and above the former, roundish, much larger, and free, through which the vestibule is reached. In front of the just-described space of the drum cavity, at a distance of 5 mm. and immediately adjoining the lower wall of the carotic canal, we found a shallow depression, barely 1 mm. in diameter,—probably an indication of the completely obliterated osseous Eustachian canal. It was lined with connective tissue and elastic fibres, in the meshes of which were large round and oval cells with similarly shaped small nuclei which took a bright carmine stain.

In the posterior portion of the middle ear, separated from the above-described drum-cavity by a sclerotic mass of bone, 2 mm. broad, was found another hollow space of approximately oval form, measuring 7 mm. in the longitudinal, and  $2\frac{1}{2}$  mm. in the transverse diameter, which was filled with a tissue of the same structure as that described in the supposed rudiment of the Eustachian tube. At the extreme limit of this space, anteriorly and above, was the stapedius muscle.

There were absent, therefore, the membrana tympani, the annulus, all the ossicles including the plate of the stapes, the tensor tympani, the nerve-plexus of the drum-cavity. An indication of the petrous fossa was present at the inferior surface of the petrous bone; the canaliculus tympanicus, however, was obliterated.

We found the entire osseous and membranous labyrinths normally developed, excepting the communication between vestibule and cochlea, which we could not demonstrate in spite of repeated endeavors. We shall only briefly state the normal condition of the acoustic nerve at its bifurcation into a ramus cochleæ and vestibuli, the normal state of the several cochlear convolutions, of the membranous formations of the semicircular canals and the vestibule on microscopic examination. We have already stated that the facial nerve could be followed only as far as the hiatus canalis Fallopii.\* The nervous petrosus superficialis major was present; the ganglion geniculi was absent.

*Remarks.*

From what has been stated, it appears that the case was one of arrested development in the region of the first branchial arch. That such a state may be excluded in the region of the second branchial arch is probable by the existence of a cartilaginous nucleus in the styloid process (Politzer), as well as by the existence of the stapedius muscle. According to Reichert, the portion of the second branchial arch which does not change into cartilage becomes the stapedius muscle; it is followed by a longer piece of cartilage which coalesces with the pars mastoidea of the primordial skull, which, if it ossifies, forms the papillary eminence on the posterior wall of the drum-cavity, and the styloid process. The described position of the stapedius muscle is not surprising, at least regarding its distance from the partially obliterated drum-cavity; for "the auditory ossicles at first are placed above and behind the drum-cavity, and, only subsequently they apparently become

\*At least in a peripheric direction we could find nothing further of the nerve. On inquiring of Dr. Bloch in regard to a possibly present paralysis of the facial nerve, we received the following reply: "Neither I nor the parents of the child, whom I specially asked to-day about it, have noticed symptoms of right-sided facial paralysis. The child made a normal use of its facial muscles during crying and nursing, as far as we can remember at this date."

situated in the drum-cavity—a remark equally true of the chorda tympani, the stapedius, and the ligaments of the ossicles.”\*

The disturbance of development probably was caused by an early irritative process which led to an *abnormal osseous new-formation*; for all the missing parts were entirely, and the air-spaces partially, replaced or obliterated by a dense mass of bone. As the malleus and incus, “at first entirely cartilaginous, commence to ossify in the fourth month of life,”† the irritative process must have occurred at an earlier period.

Although it is well known that the labyrinth develops independently of the middle and external ears, we may yet especially emphasize the normal state of its osseous and membranous parts. The above-described anomaly of the two labyrinthine fenestræ is not at all surprising, being the obvious consequence of the osseous new-formation in the middle ear; nor is the absence of the stapes which, at any rate, as demonstrated by recent investigations, develops, not from the second branchial arch, but independently from the walls of the labyrinth.

In many respects the case resembles one reported by Moos in the ARCHIVES OF OPHTHALMOLOGY AND OTOL-  
OGY, vol. ii, No. 1, p. 139. In that, likewise, the disturbance was in the region of the first branchial arch, for the membrana tympani, malleus and incus were absent. The drum-cavity, including the passage to the fenestra rotunda, and the latter itself, were obliterated by bone, leaving only a small cavity beside and below the region of the stapes. The osseous tube was also narrowed to an opening the size of the point of a pin; but the styloid process—the case was that of an adult—was complete, and the stapes, although somewhat defective, was present, as was the external meatus. In this case, too, the labyrinth was normally developed, while there was a defective development in the labyrinth of the left side. The entire inner ear, namely, was obliterated; the semicircular canals, vestibule

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\*Koelliker: *Entwicklungsgeschichte des Menschen*, etc., 2d ed., p. 746.

† Koelliker, *l.c.*, p. 472.

and cochlea, as well as the two fenestræ, were absent. Similar conditions have been described by Montain and Saissy in deaf-mutes.

It is remarkable that in this case the osseous obliteration of the auditory meatus was again found on the right side, as in most of the cases observed hitherto. The alterations described support the view that such cases should be looked upon as a *noli me tangere* in respect to operations. Assuming even that in such a case, where the labyrinth did not share in the disturbance of development, the fenestræ of the labyrinth were quite normal, it still would be a surgical impossibility to produce a passage which would permit a continuation of the vibrations of sound, through air-conduction, as far as the wall of the labyrinth. On the other hand, there can be no doubt that where the labyrinth is quite normal, in cases of osseous occlusion of the external meatus, the bone-conduction would convey sound sufficiently to protect the child from deaf-mutism. In support of this view, we may cite a case, observed by Moos, of bilateral osseous occlusion of the external auditory meatus, with unilateral malformation of the auricle, in which speech could be understood at the distance of several metres, and deaf-mutism was out of the question.\*

In this connection, the view of Toynbee is noteworthy, who states, and supports his opinion by some cases, "that in congenital malformations of the ear we may expect, as the general rule, a sufficient development of the organ for the purposes of education and the earning of a living."

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\* Silvio Escolano, in the *Monatsschrift für Ohrenh.*, No. 10, 1880, gives an abstract of a case published by A. Fernandez Palacios, a physician of Almeria, in the *Revista de Medicina y Cirugía práctica*, J. vii, No. 99.

There was an atresia of the external auditory meatus and absence of both auricles in a girl of 12, who was not well developed. "It is surprising that, despite these anomalous anatomical conditions, the functional activity of the organ of hearing is pretty well preserved; only it may be noticed that the girl, on listening, unconsciously and almost automatically opens her mouth, although she can hear—though not as plainly as otherwise,—with mouth and nostrils closed, whatever may be said in a loud or low voice. As this preservation of the auditory function speaks for the integrity of the middle ear and the labyrinth, the opinion would seem justified that an operative interference would give normal conditions to audition. Unfortunately the relatives will not permit this."

This communication cannot modify our opinion, expressed in the text, about the non-execution of the operation, because it presupposes normal conditions beyond the atresia of the external auditory meatus which are by no means demonstrated.

## THE COTTON-PELLET AS AN ARTIFICIAL DRUM-HEAD.

By H. KNAPP.

SINCE Yearsley in 1848 recommended a moist cotton-pellet, and Toynbee in 1853 a small India-rubber disc, as a means for improving the hearing of persons whose drum-heads were more or less defective, the discussion on the subject of the artificial drum-head has passed through various stages. At the present day there is still so great a divergence of opinion about the usefulness of this little contrivance, the mechanism of its action, its best form and material, its mode of action, its indications and counter-indications—to say nothing of its curative effects—that new observations do not yet appear to be out of order. The earlier authors on the subject, viz., the inventors; further, V. Tröltsch, Politzer, Moos, Lucae and others, were very sanguine about its efficacy, and spoke of many or very many cases in which an artificial membrana tympani had considerably increased the acuteness of hearing. Then a period of reaction set in, in which only in exceptional cases some value was ascribed to the artificial drum-head. This period is not yet over, for, unless I am mistaken, the artificial drum-head is only rarely resorted to, or, if tried at all, laid aside after the first unsuccessful attempts. Dr. C. E. Hackley,\* of this city, says: "This little appliance does not seem so generally used as it deserves." Dr. A. H. Buck in his recent, very valuable text-book† probably ex-

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\* These ARCHIVES, viii, p. 228, 1879.

† "Diagnosis and Treatment of Ear Diseases." W. Wood & Co., New York 1880, pp. 277.



presses the present opinion of the majority of aurists—and up to a year ago it was also the opinion of the present writer—in the brief mention he makes of the subject, which is as follows: “So far as the symptom of deafness is concerned, a certain degree of relief may be obtained in a few cases by the wearing of Toynbee’s artificial drum-membrane. I have not seen more than four or five cases in which this contrivance, or some substitute for it, materially increased the acuteness of the patient’s hearing. At the same time, I must confess that my lack of faith in its efficacy has led me to test its virtues in comparatively few cases. Furthermore, the presence of such a foreign body in the meatus, and in close contact with the drum-membrane, or with the stump of the manubrium mallei, is very annoying to the great majority of patients.”

Most of the other text-books devote—I believe, deservedly—more space to this subject, and though they teem with repetitions, each author speaks of the benefit which the little device has rendered to many of his own patients.

Dr. Hackley in his above-mentioned communication says (page 229) “the best instrument that we at present have is Toynbee’s artificial membrana tympani.” This statement is flatly contradicted by Dr. C. H. Burnett, of Philadelphia, who begins his very interesting paper on “Uninterrupted Wearing of Cotton-Pellets as Artificial Drum-Heads”\* with the following words:

“There has never been but one useful kind of artificial drum-head, and that is the cotton-pellet of Yearsley.” This statement is too sweeping, for, apart from many well authenticated cases, I know that two years ago, Dr. Hackley, at my request and in my presence, used, with great and, as it seems, lasting benefit, Toynbee’s artificial drum-head in a patient whom I had treated off and on during several years for attacks of purulent and desquamative otitis media. Nevertheless, I must confess that I personally have not had much good luck with the rubber disc, but the cotton-pellet has given me great satisfaction, as the subjoined cases will show. The same experience has been made by other ob-

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\* *Am. Journ. of Otol.*, ii, p. 14, 1880.

servers, and among them I take particular pleasure in mentioning Tröltzsch, for his remarks on the artificial drum-head in the newest editions of his invaluable text-book are very clear and instructive. He says: \* "After having become acquainted with Hassenstein's little cotton-forceps, I have almost completely abandoned the use of the artificial drum-membrane proper. A number of patients wear the cotton-plugs for years with constant relief of their deafness and material benefit as to the suppuration." I can corroborate this statement by an example that is probably more conclusive than any one on record. A full history of the case may be of interest to our readers, as it exhibits almost all the points connected with the wearing of an artificial drum-head.

CASE I.—*Otorrhœa of seven years' duration relieved in two months. Cotton-pellets worn with great benefit for 29 years.*

Mrs. J. W. K., æt. 41, a wealthy and cultivated lady of this city, had scarlet fever when she was five years old. Copious offensive discharge followed until she was 12 years. She grew so hard of hearing that she could understand people only when they spoke loud and directly into her ears. Dr. F. A. Cadwell then took charge of her case, and in two months considerably relieved the discharge by syringing the ears and pouring liquids in. After this he put cotton-plugs into both ears, which, on account of the discharge, had to be changed frequently for a long time. The doctor did this himself until the discharge had almost disappeared. Ever since that time, that is about 29 years, she has worn the cotton-pellets, and by their aid has always enjoyed good hearing, and has been free from pain and inflammation. Five or six years ago, when I had operated on her mother for glaucoma, she mentioned her ear difficulty to me, and allowed me to examine her ears. I found that without the pellets she understood conversation only at the distance of a few feet; with them, at twenty.

Last week I examined her again for the sake of this communication, and learned the following: At times she changes the cotton daily, but mostly every two or three days. When she leaves it in longer, for instance a week, it becomes dry and is of no use. It is only good as long as it is moist, which is seldom longer than three or four days. She takes it out when the ears feel uncom-

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\* Text-book, 5th edition, pp. 402, 873.

fortable, or when discharge is noticeable, or the hearing bad. After the removal of the pellet, she pours a few drops of warm water into the ear, lets it in for about five minutes, and then dries the ear with absorbent cotton wound around a dentist's cotton-holder. Syringing the ear is apt to make her dizzy, and the water runs into her throat. When she leaves the cotton out for several days, the discharge at once diminishes, and soon the ears dry up. When she then inserts the cotton-pellets again, she hears very well, better than before. She removes the cotton and puts a new piece in with a delicate pair of forceps. She shapes it into a thin disc, like a wafer, about a centimetre in diameter, soaks it with pure glycerine, seizes it with the forceps in the centre, and pushes it into the ear as deep as she can. If the hearing is not at once improved, she does not make many attempts at adjusting the pellet, but prefers to take it out and put a new one in. Sometimes the ears immediately after the insertion feel plugged tight, and the hearing is bad, then by blowing her nose, or from itself, a bubble seems to burst with a snap, upon which the stopped feeling disappears, and she hears well again. A minute after she has inserted the pellet, a watery discharge runs from her ears for several hours. Supposing that the pure glycerine caused this abundant secretion, of which my other patients who use 1 part of glycerine to 3 parts of water have not complained, I advised her to dilute the glycerine. This had the desired effect. The ear did not run, and felt comfortable even immediately after the insertion. She could wear the pellets a day longer than usual, three days in all, before she felt any annoyance.

The condition of her ears on the day of the examination was as follows: Pellets in for 24 hours,  $h \frac{1-2}{24}$ ,  $v \frac{20}{60}$  each ear. The cotton-pellets removed are of moderate size, oblong, moist with some pus which is slightly greenish, almost free from odor. [When the discharge grows offensive and copious, she changes the cotton oftener and cleanses the ear more frequently and carefully, without, however, employing any remedy.] Her acuteness of hearing was R  $h \frac{1}{\infty}$ , on temple faint, on mastoid distinct;  $v \frac{3}{60}$ ; L  $h \frac{1}{24}$ ,  $v \frac{6}{60}$ . The fundus of the right ear was covered with a moderate quantity of pus which required the introduction of the cotton-holder three times to remove it fully. In the left ear there was only a very small quantity of pus. In the right ear the handle lay bare and was united to the promontory; behind its upper part, close to the short process, was a vertical fold of pale-red mucous membrane, corresponding to the lower part of the

descending process of the handle. The mucous membrane of the promontory was red, even, and free from granulations. At the periphery there was a doubtful indication of a remnant of the drum-membrane. The mucous membrane of the left tympanic cavity was red, even, and thin. In the upper part of the cavity there was red fibrous-looking tissue, probably enveloping the ossicles. This tissue, as well as the adjacent part of the ear-canal, was covered with collections of white scales. She soaked the cotton-wafers with pure glycerine, introduced them as described above, and immediately heard well again, namely  $v \frac{2}{3} 0 +$ , in each ear. A few minutes afterward I noticed clear liquid running from her ears.

I do not think that there is another case on record in which the cotton-pellets were worn twenty-nine years. If we bear in mind that Yearsley published his first observations in 1848, she must be one of the oldest patients that derived benefit from his method of treatment. She considered it the turning-point in her existence. It rendered her capable of receiving a good education, fit for society, and equal to the requirements of civilized life. Without it she would not have been in a much better condition than a deaf-mute.

Moreover, let us not forget the *protective effect* of the pellets. Before she wore the pellets, she had constant offensive otorrhœa with all its annoyances and dangers. The pellets, by judicious manipulation, enabled her to regulate the secretion in such a way as was most suitable for audition: on the one hand, checking the discharge when it showed a tendency to grow profuse; on the other, preventing the structures still preserved in the tympanic cavity from becoming sclerosed and stiff by exsiccation. And for twenty-nine years she has worn the pellets with comfort, free from inflammation and pain. To-day they benefit her hearing as much, and are as indispensable to her, as in the beginning, while the anatomical condition of the middle ears presents no degenerative processes, there being neither cicatricial atrophy of the mucous membrane (sclerosis) nor proliferation (granulations and polypi). There never has been any caries or mastoid complication. I think any practitioner, however skeptical, may take this case as a precedent for the management of similar ones.

Since I have paid more attention to this subject, I find that the group of cases in which the cotton-pellet affords material service, is much larger than I formerly believed it to be. Another illustrative example of recent date is the following:

CASE 2.—*Otorrhœa for 16 years. Cotton-pellets great aid to hearing.*

Mr. J. C., æt. 20, of New York, consulted me first Dec. 20, 1880. Ear disease and discharge from his fourth year. Hearing changing, but always bad. On examination *h* o in each ear, *v*  $R \frac{3}{8}$ ,  $L \frac{2}{8}$ ; audiphone  $\frac{5}{8}$ ; dipper-trumpet  $\frac{1}{8}$ . Moderate quantity of dark offensive pus removed with cotton-holder. Mucous membrane of drum-cavity red, slightly thickened. Drum-membranes not to be discovered. Toynbee's artificial *Mt* produced no improvement of hearing; a moistened cotton-pellet, pressed tight into the ears, gave *v*  $R \frac{1}{8}$ ,  $L \frac{1}{8}$ . Patient delighted. He heard well the whole day. After removal of the cotton, he heard badly again, nor did he succeed for a whole week in putting a fresh plug in that afforded great aid to his hearing.

He returned Dec. 27th. *v*  $\frac{3}{8}$ ; with pellets  $\frac{5}{8}$ ; unsatisfactory. No secretion. I advised him to leave the cotton-pellets, which were moistened with a 25-per-cent. solution of glycerine, in the ear for three days and then let me take them out. When he came, December 31st, I found *v*  $\frac{3}{8}$ , and the pellets saturated with somewhat greenish pus. I ordered him to syringe his ears gently but carefully every morning and evening, put a 4-per-cent. solution of boracic acid in, and stop the ears up with dry absorbent cotton. In a week the discharge had disappeared. He was directed to introduce the cotton-pellets, moistened in glycerine and water, every morning, removing them in the evening, and cleanse the ear by syringing before the insertion and after the removal. In doing so he felt no inconvenience; the discharge was moderate and free from smell; and *v* varied from  $\frac{1}{8}$  to  $\frac{1}{8}$ , without the cotton it was never higher than  $\frac{3}{8}$ . Any attempt at leaving the cotton-plugs longer than a day, was followed by increased discharge and diminution of hearing. On March 27th, *i.e.*, after three months' treatment, I made a careful examination, which showed the following: With pellets inserted by himself *h*  $\frac{1}{8}$  each, *v*  $R \frac{3}{8}$  +,  $L \frac{3}{8}$  —. After removal of pellets *h* o (everywhere), *v*  $\frac{3}{8}$ , each. No discharge; cleansed ears in the morning. Both ear-canals narrow, walls normal. In left ear no *Mt*, no ossicles visible, mucous membrane red, but only slightly swollen, with probe not ten-



der. In right ear cartilaginous ring preserved ; handle absent ; the place of the oval window covered with mucous membrane ; the entrance into the niche of the round window filled with liquid, slightly depressed, a small bright reflex in the centre. He inserted large cotton-pellets again, upon which  $L \frac{1}{2}$ , ear and temple distinct, mastoid faint,  $v \frac{1}{6}$ ;  $R \frac{1}{2}$ , ear distinct, temple faint, mastoid 0;  $v \frac{1}{6}$ .

In this case of almost total absence of the *Mtt*, where the ossicles could not be detected, and the otorrhœa was of fourteen years' duration, the cotton-pellets were a great aid to hearing, raising  $v$  from  $\frac{2}{6}$  to  $\frac{1}{6}$  in each ear. They caused no discomfort to the patient, but had to be changed every day, and the ears required cleansing twice daily. It is quite possible that they may be left longer when the discharge diminishes.

These two cases show that the cotton-pellets may be of material advantage to hearing, when there is a certain degree of discharge. In this condition they have to be changed daily, or every few days. There is another group of cases in which, as already Tröltsch remarks, the pellets are of particular service to hearing, namely, when the tympanic cavity is too dry, and, I may add, when there is desquamative otitis media. It is generally known that many patients hear better when their ears run than when they are dry. Almost all these cases can be benefited by the moist cotton-pellet, which not only imparts moisture to the mucous membrane of the drum-cavity, but also prevents it from exciccation by shutting it off from the atmosphere. I may be permitted to illustrate these conditions by two examples :

CASE 3.—*Otitis media chronica desquamativa. Acoustic and curative effects of cotton-pellets excellent.*

Mr. N. J. W., æt. 55, of New York, has been under my care, off and on, for six years. January 14, 1875, he consulted me first. Diagnosis: *R otit. med. desquamativa, L sclerosis.*  $v R \frac{2}{6}$ ,  $L \frac{2}{6}$ . The disease resulted from scarlet fever when he was four years old. The right ear has discharged more or less all his life, the left only now and then. The hearing in each ear varied. Dec. 22, 1880, he came to me complaining



that for a week or two his hearing had been unusually bad, incapacitating him for his profession. I found  $v \frac{2}{6}$  in each ear. The left drum-cavity was sclerosed as before; the mucous lining of the right, and the adjacent parts of the canal were thickened and covered with white scales, most marked at the anterior wall of the drum-cavity. I filled the ear with warm soap-water, left in for half an hour. Into the left I introduced a moist cotton-plug. As the right ear could only imperfectly be cleansed by syringing, I swabbed it with cotton-wool. Then I removed the plug from the left ear. The handle was preserved in both ears, the drum-heads were almost totally absent. I soaked cotton-pellets in one part of glycerine to four parts of water, shaped them into wafer-like discs, and spread them carefully over the inner wall of the drum. At once the patient readily understood ordinary conversation across the room ( $v \frac{2}{6}$ ) with each ear. He felt comfortable, and went away delighted. I had directed him to leave the pellets undisturbed for two days, and come again. His hearing then was still  $v \frac{2}{6}$  in each ear, but there was an unpleasant discharge in the right. The cotton-plugs were removed, the right ear cleansed as before, the left was congested and slightly moist, but free from pus. Cotton-pellets were introduced again with the same result. Patient left them in for four days; in the left the pellet was scarcely moist, in the right there was considerable and offensive discharge. It was now possible to cleanse the right ear completely from the tenacious deposits of white scales. Patient was advised to change the cotton-pellet in the right ear every day, and leave it in the left for a week. When he returned there was only little and inodorous discharge in the right. In the left the cotton-pellet was dry and lay in the middle of the ear-canal. The patient's hearing was now  $v \frac{2}{6}$  in each ear, whether he had the cotton-pellets in or out. He was directed to wear only a very thin piece of dry cotton in the right, and a very thin cotton-wafer, soaked with the glycerine lotion, in the left, either on the inner wall of the drum or near it. In this way the patient does very well. He comes to see me from time to time, and according as I find the condition of the drum-cavities, I advise him to modify his treatment.

CASE 4.—*Large defects in drum-heads; R chronic otorrhœa; L no discharge. Cotton-pellets improve hearing in both ears, and rapidly cure the discharge in the right.*

Quite recently, March 25th, Miss A. M. T., æt. 28, of this city, came to me. She had had otorrhœa from her childhood. I found

large perforations in both *Mtt*, the handle preserved only in the left ear, the mucous membrane of which was not swollen;  $v \frac{1}{8}$ , with cotton-pellet  $\frac{2}{8}$ . R discharge moderate;  $v \frac{1}{8}$ , with pellet,  $\frac{4}{8}$ . Directed to wear the cotton-pellets, soaked in glycerine-lotion, in both ears for several days. She returned six days later. The cotton-plug in the right ear was saturated with thick pus; that in the left was dry. Pellet introduced again in the right ear only. Three days later it came out only slightly moist. There was no discharge. Syringing removed only inspissated granules and flakes. Mucous membrane red and moist.  $v \frac{2}{8} +$ , after reinsertion of pellet,  $v \frac{2}{8} -$ ; L mucous membrane somewhat moist;  $v \frac{2}{8}$ . A thin piece of cotton to be worn only in outer part of the ear-canal. Four days later the hearing in each ear was  $v \frac{2}{8}$ . The cotton in the right ear was dry. It adhered to the inner wall of the drum. Removed with a forceps it showed a white, dry pellicle, 5 mm. in diameter, attached to its inner end. Some scales on the ear-canal. Water passed from the ear into the throat. Mucous membrane not swollen. Cotton only in outer part of canals. Two days later she returned;  $v$  R  $\frac{2}{8}$ , L  $\frac{1}{8}$ . A flake of mucus was on posterior lower part of inner wall of left drum. Syringed out. Pellets, moistened with glycerine lotion, inserted into the depth of both ears;  $v \frac{2}{8} +$  in each. Patient feels very comfortable.

She stated that the right ear had discharged more or less, and the hearing in it had been dull as long as she could remember. The left ear had almost always been dry, the hearing in it very changeable; better when it ran. At times she removed the deafness by syringing. April 8th, when she presented herself last with no discharge but good hearing ( $v \frac{2}{8} +$ ) in either ear, she was directed to protect the ears with small pieces of dry cotton, placed at the entrance of the canals, as long as she heard well and felt comfortable, but to put moist (glycerine, 1 part; water, 3 or 4 parts) pellets deep in when the ears were dry and the hearing was bad. Other directions I need not mention.

I abstain from reporting other observations. The four cases here described will serve as evidence for the points which I desired to make, and which I may summarize in the following statements:

1. Cotton-pellets, moistened with glycerine and water (1:4), and worn as artificial drum-heads, are a great aid to

hearing in many cases of partial or total defect of the natural drum-head, with or without otorrhœa.

2. Their therapeutical action in arresting profuse discharge on the one hand, and preventing the mucous membrane of the drum-cavity from drying up on the other, is most valuable.

3. They protect, like the natural drum-heads, the deeper parts of the ear against injurious influences of the atmosphere.

4. In some cases they are quite indispensable, and may be worn for a lifetime with permanent comfort and benefit.

5. In other cases they are needed only periodically, according as the copiousness of the discharge or the exsiccation of the mucous membrane requires their action in the one or other direction.

6. The period during which a pellet may be left in the ear varies with the condition of the parts. They should be changed frequently, *i. e.*, every day, or every few days, so long as the discharge is considerable. They should not be worn at all when the discharge is abundant and offensive. When there is no discharge, they may be left as long as they are comfortable and the hearing is good. So far as my experience goes, they are apt to become unclean in a week or two. They then ought to be removed, the ear cleansed either with dry cotton, or cotton steeped in warm soap-suds, and new pellets introduced.

7. The management of the ear-disease should remain in the hands of the physician until a stationary condition, either of slight or no discharge, has been reached. During the time the patient is under treatment, he can be taught how to cleanse his ears and remove and replace the pellets.

It was not my object in this paper to consider the mode of action of the artificial drum-head, nor its value in the restoration of defects in the membrana tympani. I purposed, on my part also, to call attention to the acoustic and therapeutical importance of the cotton-pellet. If my remarks are of no account, the cases reported, added to those of other observers, are certainly qualified, not only to justify but to stimulate efforts of investigation in this direction.

## QUARTERLY ABSTRACT OF AMERICAN OTOLOGICAL LITERATURE.

By SWAN M. BURNETT, WASHINGTON.

1. Functions of the Eustachian tube. By T. F. RUMBOLD, *St. Louis Med. and Surg. Jour.*, July 20 to September 5, 1880.

The conclusions at which R. arrives from a number of observations which are given in full, are :

"1. That during the act of deglutition, the Eustachian tube is *not* an open passage into the tympanum.

"2. That the walls of the Eustachian tube are constantly in slight contact.

"3. That the air continuously permeates the Eustachian tube into the tympanic cavity.

"4. That the air in the normal tympanic cavity is not of equal density with that of the surrounding atmosphere, the air in the tympanum being rarefied.

"5. One of the functions of the Eustachian tube, may be the principal one, is the maintenance of this inequality of air-density.

"6. That the rarefied condition of the air in the tympanum is the cause of the uniform concavity of the *Mt.*

"7. That a certain degree of uniform pressure on the fluid in the internal ear, by means of the *Mt.* and the small bones of the ear, is essential to normal hearing."

2. On the sympathy existing between the ear and the larynx, and the ear and the teeth. By C. H. BURNETT. *Specialist and Intelligencer*, November, 1880.

Dr. B. relates some cases which, he believes, substantiate the reflex connection between the ear and teeth; and the ear and larynx.

3. Otorrhœa. Hints on treatment. By H. GRADLE. *Chicago Med. Review*, December 20th.

He uses the antiseptic method. Has found 5 per-cent. solutions of carbolic acid very useful where there is much fetor, but the least annoying of all applications is powdered boracic acid poured into the ear after thorough cleansing and drying.

4. Report, in brief, of the Aural Department of Jeff. Medical College Hospital. L. TURNBULL, in charge. *Med. and Surg. Reporter*, January 15th.

During the year, 208 new cases were treated, and 49 operations performed. Inflation by Politzer or the catheter, with hydrobromic ether, was found to be beneficial in tinnitus aurium, as were also 15 drops of hydrobromic acid after meals.

5. On false hearing and autophony in singers, speakers, and performers on certain musical instruments. By SAMUEL SEXTON. *N. Y. Med. Record*, January 22d.

S. defines pseudacousma (false hearing) as that condition in which the sound of the speaker's own voice, instead of coming from the outside, appears to come directly from the throat into the auditory apparatus. This autophony is false as regards the normal manner of hearing one's own voice, and may also be false as regards pitch and timbre. In treating of this anomaly, as found in musicians, he divides his patients into two classes: vocalists, and performers on musical instruments, giving eleven cases in all.

He concludes from a study of these cases that the trouble in most instances is to be found in the middle ear—and not in the labyrinth as has been commonly believed. The abnormal conditions being, as he supposes, alterations in the ossicular connections and a relaxed condition of the *Mt.*

In the discussion of this paper in the New York Academy of Medicine (same number of the *Record*) Dr. ROOSA expressed a decided difference of opinion from the author as regards the seat of the morbid process in this class of cases. Though the middle ear was often involved, it was only when the labyrinth was secondarily affected that false hearing was noticed.

Dr. KNAPP classified the various forms of false hearing according to the fundamental qualities of sound, intensity, pitch, and clang-tint. He had never seen a case where the last was affected. Intensity of sounds was influenced by abnormal conditions of the

conducting apparatus, the condition of the Eustachian tube being an important factor. Anomalies in pitch, however, he could not explain in this way. For the production of this, there must be, from some cause, a false tuning of one of the cochleæ or part of it. Confused or muffled hearing was caused by defective isolation and damping of the fibres of the basilar membrane. Anomalies of pitch, in cases of inflamed drum-cavity, were due to propagation of the morbid process from this point to the inner ear. Prognosis in such cases is, as a rule, good.

Dr. O. D. POMEROY agreed in general terms with the opinions of the essayist, but thought there was defective tuning of the fibres of Corti. More light, however, was needed before a positive opinion could be formulated.

Dr. HOLCOMBE thought that in his own case, the phenomenon of double hearing was due to pressure on the labyrinthine fluid, but the trouble disappeared when the mucus, which had collected in the middle ear, was removed.

In closing the discussion, Dr. SEXTON said it was difficult to establish the use of Corti's organ. Did it separate compound tones? He thought the mental act necessary to their perception, and comprehension did not require a cognizance of the separate elements of tones, as it probably receives them as a whole. The combination he believes to be made before transmission to the nerve of hearing takes place. As regards the semicircular canals, he had these structures in his possession taken from one ear of a patient who lived and walked as well as any one.

6. Suppurative inflammation of the middle ear. By W. T. MONTGOMERY. *Trans. Ill. State Med. Soc.*, 1880.

A general survey of the subject of chronic suppuration of the middle ear, in which there is nothing new offered to the specialist.

Imperfect hearing, and the hygiene of the ear. By LAURENCE TURNBULL, M.D. 8vo, pp. 147. Philadelphia: J. B. Lippincott & Co., 1881.

This brochure is the third edition of Dr. Turnbull's pamphlet on "Tinnitus Aurium," published some years ago. This is sufficient evidence of its popularity. Much additional matter has been introduced, and we have now a collection of monographs on several subjects which are of great interest to otologists. Dr. T. has thoroughly posted himself on the literature of the subjects on



which he writes, and his own experience and observation have contributed largely to the value of the several papers.

The subjects treated of include an "Introduction," giving the recent progress of otology ; "The limit of perception of musical tones by the human ear ;" "Tinnitus aurium, and observations on aural or auditory vertigo, with diagnosis and treatment ;" "The importance of treatment of the naso-pharyngeal space, tonsils, and uvula, in acute and chronic catarrh of the middle ear ;" "Artificial perforation of the membrana tympani ;" "The mastoid region and its diseases, with illustrative cases ;" "The hygiene of the apparatus of hearing, with the prevention of deafness ;" "On the method of educating the deaf-mute at home, and on the selection of proper schools for the deaf and dumb ;" "A comparison between the audiphone, dentaphone, etc., and the various forms of ear-trumpets."

Diagnosis and treatment of ear diseases. By A. H. BUCK, M.D. pp. 411. New York : Wm. Wood & Co., 1880.

This work of Dr. Buck's is of special interest to the aurist, from the fact that it is a record of his personal experience on all the topics touched upon. He has wasted no time in giving those views and opinions of others which his observation has taught him are of less value than those he has adopted. There are many points of interest, particularly where he has dissented from the views held by almost common consent, which we should like to touch upon, but our limited space forbids us doing so in any great detail. In the first place, he recommends that in the removal of foreign bodies, cerumen, etc., from the ear, the syringe should be the exception rather than the rule. If the work were intended solely for the use of experienced specialists, no great harm might come from this teaching, but we cannot but believe that such a statement, coming from such an acknowledged authority as Dr. Buck, and in a work belonging to a series intended rather for the library of the general practitioner than for the specialist, is likely to be pernicious in its results.

In the treatment of catarrh of the middle ear he is opposed to intratympanic injections, and only in rare cases performs paracentesis of the *Mt.* In the purulent form, however, he does puncture as soon as there is any marked bulging of the drum-head. He treats the pharynx by means of argt. nit. in sol. of from 15 grs. to 40 grs. to  $\frac{3}{4}$  i. aq. This is applied by means of cotton on a cotton-holder bent nearly at right angles so as to allow it to be pushed

well up behind the palate. For inflation he prefers Politzer to the catheter, and he thinks that, as a rule, inflation every other day is of sufficient frequency. He seldom continues treatment for longer than four or five weeks. He then gives a rest for a few weeks to resume treatment again. In the dry form of catarrh, which he calls "chronic subacute catarrh," when the diagnosis is unmistakable, there is little or no hope for benefit from treatment.

The chapter on purulent inflammation of the middle ear is one of peculiar excellence. He has come, as the result of his experience, to use no astringent but argt. nit., except in rare instances. He does not express it as a positive opinion, but thinks that syphilis may manifest itself in the middle ear. His chapter on diseases of the mastoid is one which every otologist should read, while that on fractures of the temporal bone could be read with profit as well by the general surgeon.

## REPORT ON THE PROGRESS OF OTOTOLOGY IN THE THIRD QUARTER OF THE YEAR 1880.

Translation by R. C. BRANDEIS, M.D., of New York.

### I.—NORMAL AND PATHOLOGICAL ANATOMY OF THE ORGAN OF HEARING.

BY DR. H. STEINBRÜGGE, OF HEIDELBERG.

1. C. F. W. ROLLER (Anatomical Institute, Strassburg). The ascending root of the acoustic nerve. *Archiv für Microscopische Anatomie*, vol. xviii, part 4, page 403.
2. Dr. LEO GERLACH. (a) The preparation of the ossicles of the human ear as specimens for demonstration. (b) On the presence of two ampullæ in the outer (horizontal) semicircular canal of the bony labyrinth. Meeting of the Physico-Medical Society of Erlangen, Nov. 10, 1879.
3. H. KRATZ. On congenital fistula of the first branchial fissure. Inaugural thesis, Bonn, 1880.
4. Dr. EVE. Aneurism by anastomosis of the ear. Demonstrated before the Pathological Society of London, April 20, 1880. *British Medical Journal*, April 24, 1880.
5. J. CLARENCE BLAKE, M.D., Boston. On the occurrence of exostosis within the external auditory canal in prehistoric man. *American Journal of Otology*, vol ii, No. 2.
6. EDWARD ZILLINGER. Aural hemorrhage in suicide by hanging. *Wien. Med. Wochenschrift*, Nos. 35 and 36, 1880.
7. LEWIS W. REYNOLDS. Case of perforation of the membrana tympani from ascaris lumbricoides. *The Lancet*, Oct. 23, 1880.
8. HENRY MORRIS. Contributions on mastoid disease. *Lancet*, May 28, 1880.

9. E. KELLER, Cologne. Additional contribution to the knowledge of necrosis of the temporal bone. *Berlin Klin. Wochenschr.*, No. 44, 1880.

10. THOMAS BARR. Three cases of cerebral abscess consequent upon suppurative disease of the middle ear; with remarks. *The Glasgow Medical Journal*, vol. xiv, No. 7, July, 1880.

11. J. LUYLS. Contributions to the study of cerebral localization; long-standing deafness; atrophy of both occipital lobules. *Gazette Médicale*, No. 29, 1880.

12. MARTIN SAALFELD, Stettin. On the so-called pharyngitis granulosa. *Virchow's Archiv*, vol. lxxii, part 1, page 147.

1. According to Roller, the ascending root of the acoustic nerve arises from the funiculus cuneatus of the cervical portion of the spinal cord (which contains numerous large, round cells), from which longitudinal fascicles branch off, which can be traced into the large-celled acoustic focus (Henle's upper acoustic nucleus). They contribute to the formation of the inner root of the acoustic nerve (Henle's posterior medial cord), inasmuch as a part passes directly into it, while another first unites with the cells of the focus. A second bundle, which enters the same focus, comes from above through the pons Varolii, as well as other fibres from the cerebellum. The large-celled focus is, therefore, a central meeting-place for different bundles of fibres.

2 (a). GERLACH glues small discs of wood, about 3 mm. in thickness and 12 mm. in diameter, upon microscope slides, fastens one of the ossicula auditūs to the glass slides by means of glue, and seals the cavity with a glass cover which is firmly adherent to the wooden disc. By this means the specimen can be examined from all sides. In order to demonstrate the mutual relations of the ossicula, one to another, fine platinum wires are glued to them; the other end inserted into a cork disc in such a manner that the normal position of the bones is established. The vibrations of the ossicula and their axis of vibration can be shown by suspending the chain of bones between two small up-rights, 3 cm. apart, by means of threads, one of which is attached to the handle of the malleus, the other to the short crus of the stapes.

(b.) GERLACH found, in a left human petrous bone whose vestibule was opened from behind, that the posterior end of the hori-

zontal semicircular canal was dilated, like an ampulla. He supposes that there may have been two ampullæ, because, in accordance with the mode of development, the cartilaginous labyrinth is first formed, and the shape of the bony canal is determined thereby.

3. KRATZ has himself seen twelve cases of congenital fistulæ. They are often associated with other malformations of the ear. One-half the cases were hereditary. These fistulæ must be looked upon as a partial maintenance of the first branchial fissure, and for this reason the author calls them as above. It was never possible to find any communication with either the external meatus or the tympanic cavity in spite of careful probing or inflation with air.

4. EVE showed the case of a girl aged 21 years. At birth, a small pulsating tumor was noticed on the right auricle, which, when she was about fifteen years old, was removed by means of ligation. It reappeared, and two years later was again operated on, but finally involved the entire auricle. The tumor pulsated slightly; a buzzing sound could be heard. The right common carotid, the temporal, and posterior auricular arteries were dilated. On examination with the microscope a dense network, composed of arterioles and capillaries, was found.

5. BLAKE examined the external auditory canals in the crania of prehistoric mound-builders. He verifies Turner's observation, that a congenital sagittal compression of the external canals, independent of any artificial malformation of the skull, is often found. In 195 skulls the average sagittal diameter was 6.3 mm. In 18 per cent. there were exostoses in one or both canals, and the antero-posterior diameter was reduced to 5.7 mm. In 50 Californian crania, taken from the graves of the islands off Santa Barbara, the antero-posterior diameter averaged 8.61 mm.; of 108 other Californian skulls, 5 showed exostoses. The causes are unknown; no traces of syphilis were found. Blake accepts Welcker's and Turner's suggestion, that these exostoses in the auditory canals are not peculiar to American crania and can probably also be found in those of the old world as well.

6. ZILLINGER reports the results of the *post-mortem* examination of a female suicide. Cyanosis of the face. Eyelids, conjunctiva, and the mucous membrane of the lips contained numerous ecchymoses. The cutis of the right meatus was detached in shreds. On the drum-membrane there was a linear rupture of

the epidermal layer. Near the umbo there were several small ecchymoses. The cavity of the tympanum was filled with blood, its mucous membrane markedly congested and also studded with ecchymoses. On the left side the conditions were almost the same. Zillinger calls attention to the gradual compression of the large vessels of the neck in attempts at suicide by hanging, and the congestions resulting therefrom. In this, as in Hofmann's cases, there were cyanosis of the face and extravasation into the mucous membranes. In 23 cases of asphyxiation from different causes, there were ecchymoses of the auditory meatus in three cases, and of the cavity of the tympanum in fifteen cases.

7. REYNOLDS' case concerns a pregnant woman, aged 35 years, suffering from ascarades, who passed several of them during emesis. Several lodged in the nasal fossæ and caused epistaxis; others entered the Eustachian tubes and also gave rise to hemorrhages, intense pain, and, after having perforated the membranæ tympanorum, crept out of the ears. From March 4th to 8th six worms, one of them four inches in length, passed through the tubes and the external ears.

8. MORRIS reports two cases of disease of the mastoid process:  
1. A man, aged 31 years, deaf for many years and suffering from otorrhœa. Pain, increased discharge, redness over the left mastoid process, chill, loss of consciousness. Trephined, temporary improvement, then symptoms of pyæmia. Herpetic vesicles in the face, which increase and coalesce; these were also found on the tongue as well as on the mucous membrane of the mouth and pharynx. At *post-mortem* the left lateral sinus and the jugular vein were occluded by a firm, adherent thrombus, which extended as far as the opening of the subclavian vein. In the right lateral sinus and torcular Herophili the coagulum was not so dense. The second case was that of a man, aged 50 years, who was affected with deafness and mastoid trouble of the left side after taking a cold bath. The membrana tympani presented no abnormal symptoms. Wilde's incision was made, and the patient recovered speedily.

9. KELLER removed a sequestrum from a scrofulous boy two years of age, which projected from a fistula situated behind and above the right auricle. The fragment of bone was  $2\frac{1}{2}$  cm. long,  $2\frac{1}{4}$  cm. broad, and  $1\frac{1}{2}$  cm. thick; a part of the sigmoid sulcus, 1 cm. in length, the tegmen tympani, and cancellous bone from the neighborhood of the labyrinth were distinguishable. There was



paralysis of the right facial nerve. Three years later Keller saw the child again. The fistulous opening was still present, and the otorrhœa persisted; the paralysis was less marked, but the right side of the face was not as well developed as the other. The defect in the temporal bone was replaced by newly-formed bone tissue. The vibrations of the tuning-fork were perceived by bone-conduction.

10. BARR'S first case was that of a boy, aged 14, who had had otorrhœa for more than 10 years, and who, after receiving a box on the ears, vomited, became feverish, and had pain on the left side of the head. Eleven days after the injury there was coma, spasmodic contraction of the flexors of the arms and legs. Death ensued. A large abscess was found in the left temporal lobe. The dura mater above the roof of the left tympanic cavity was thickened and softened. No caries. The membrana tympani was destroyed; tympanic cavity filled by a soft, polypoid mass. Malleus and sinus bathed in a brown-colored fluid; stapes not to be found.

The second case was that of a boy, aged 17, who had been deaf for eleven years. For two years past there had been occasional discharges from the left ear. After taking sea-baths he became ill, suffered severe pains, was very much prostrated, slightly aphasic, very somnolent, vomited considerably, and was constipated. Ten days later he was able to rise again and, with halting gait, went into an adjoining room. In the evening there were general tremor and unconsciousness. Paresis of the right side; the day after, coma and death. Large abscess in the left temporal lobe. A carious fistula in the roof of the antrum; a second one in the sigmoid fossa, and a third in the posterior upper wall of the external meatus. All of these fistulæ communicated with the mastoid cells. The upper half of the membrana tympani was destroyed.

The third case was that of a boy of 12, who for six years had otorrhœa of the left side, after an attack of measles. There was pain in the left mastoid region and in the occiput; chilliness, vomiting, constipation. A week later, chills, which occurred several times daily. Three weeks after the illness began, the patient died. There was an accumulation of foetid pus beneath the dura mater, on the posterior surface of the left petrous bone. The walls of the left lateral sinus were thickened, and detached from the bone by underlying pus. The cavity of the sinus was

intact. Brain healthy. Membrana tympani and the ossicles destroyed. Mastoid cells filled with cheesy matter. No caries.

11. LUYVS had a patient, aged 85 years, who had been quite deaf for 60 years, died of pneumonia. The left occipital lobe, which was quite atrophied, presented an irregular, stunted surface. The central sulcus (scissure perpendiculaire) was transformed into a deep gutter, so that the index finger could be imbedded in it. The groove which separates the *pli courbe* (lobulus tuberis) from the posterior central convolution, is also enlarged. The third frontal convolution is atrophic. The right occipital lobe is also lessened in size by atrophy of the cortical substance; the sulci are enlarged. The trunks of the auditory nerves have disappeared, with the exception of a few fibres. Luyvs quotes the *Annales des Maladies de l'Oreille* of 1876, where he published the case of a deaf-mute, aged 74 years, who, on *post-mortem*, also had atrophy of the occipital lobe.

12. SAALFELD only examined the oral portion of the pharynx. The granula, even without a microscope, often showed a small opening, the dilated orifice of the excretory duct of an acinous gland, generally enlarged and lying in the submucous layer. The neighborhood of the excretory duct is infiltrated with lymphoid cells, which in part have united to form circumscribed follicles. The normal pavement epithelium, composed of several layers, is absent in the apex of the granules. The mucous membrane between the granules is, in some cases, quite healthy; in others, thickened and infiltrated.

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## II.—PHYSIOLOGY OF THE EAR AND PHYSIOLOGICAL ACOUSTICS.

BY OSCAR WOLF, OF FRANKFORT-ON-THE-MAIN.

1. CLARENCE J. BLAKE, Boston. The membrana tympani telephone. *The American Journal of Otology*, vol. ii, No. 3.
2. ALEXANDER GRAHAM BELL, Tufts College, Mass. Experiments relating to binaural audition. *Ibidem*.
3. J. DOGIEL. The influence of music on the circulation of the blood. *Archiv f. Anat. und Physiol.*, by E. Du Bois Raymond, physiological section, parts 4 and 5, 1880.
4. R. FALKSON, Königsberg. Contribution to the knowledge of the function of the soft palate and pharynx. *Virchow's Archiv*, vol. lxxix, part 3.

5. E. BERTHOLD, Königsberg. On the influence of the nerves of the tympanic cavity upon the secretion of its mucous membrane. Address delivered in the section of laryngology. Reprint from the transactions of the 53d Congress of German Scientists and Physicians.

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1. CLARENCE J. BLAKE, who, as has already been reported, has done much to adapt the telephone for acoustic experiments, endeavored to utilize the human membrana tympani in perfecting the telephone. He prepared suitable specimens by opening the roof of the tympanic cavity and then removed the posterior portion of the petrous bone by carrying a hair-saw through the tympanic cavity from before backward, through the incudo-stapedial articulation, and exposing the inner surface of the membrana tympani with the malleus and incus in position. The specimens were washed with glycerine in order to maintain their mobility. A telephone was made whose receiving plate was equal in diameter to that of the membrana tympani; the handle of the malleus and the long process of the incus were attached to the ferro-type discs by means of resin-wax. Two of Bell's hand-telephones were attached to the conducting wire so as to have the experiments under thorough control. The results obtained were not satisfactory. When, for instance, the limit of transmission of the ordinary telephone was found to be 10.240 V. S., with the ear-telephone it was only 8.192 V. S. The tones of pipes, from 680 to 800 V. S., were plainly but faintly heard. Single tones and single vowel and consonant sounds were distinguishable, but it was again found that the consonant sounds accompanied by the greatest pneumatic pressure in their production were all heard merely as dull thuds. Having tested the ear-telephones together as transmitting and receiving instruments, one was removed and a Bell hand-telephone substituted as a transmitter; under these circumstances not only were the musical tones much more distinctly and loudly heard, but it was also possible to carry on conversation in one direction, using the ear-telephone as a receiver. It is thus found that the addition of the curved animal membrane affords no advantage for the use of the telephone.

2. A. GRAHAM BELL bases his experiments upon the fact that when we close one ear and listen to sounds through the medium of the other, we can distinguish pitch, loudness, and quality of such sounds, yet there is a feeling of incompleteness, especially in our ability to determine the origin of the sounds heard. This

uncertainty is compared with monocular vision. When both ears are employed simultaneously, a sort of stereoscopic effect of audition is perceived. In order to study these stereoscopic phenomena of binaural audition, Graham Bell arranged four telephones in such a manner that the two mouth-pieces were turned away from one another, and the instruments were so arranged that the diaphragms were about as far apart as the drum-membranes of the two ears. The left mouth-piece was connected with the left ear-piece of the receiver in an adjoining room, and the right one with its fellow also. The speaker now passed in a circle round the two mouth-pieces, and the receiver tried, while holding the two ear-pieces to his respective ears, to determine from what part of the room the sound emanated. The result of those experiments will be given further on. Another series of observations was made in the open air, two microphones being also employed whose diaphragms were about six inches apart and back to back. Here the author describes as new a method, recommended to him by Mr. Sumner Taintor, of introducing artificial resistance into the two telephone circuits. Graham Bell, at this time, was probably not acquainted with the works of Arthur Hartmann, Plu-maudon, and B. Richardson, although they were already published eighteen months ago. By introducing a greater or less resistance into the circuit of one of the two microphonic telephones, a similar condition is established as if the observer were deaf in one ear. The author adds, in conclusion: "The experiments are too few in number and too imperfect in several respects to admit of accurate generalization, but it will be seen that perception of the direction of a source of sound is less perfect by a single ear than by both ears; while the tables disprove the idea that direction cannot be appreciated by monaural observation. It will also be observed that the direction of sound is more accurately defined as it approximates to the axial line of the ears, and that the indications are proportionately at fault as the true source of sound is in any other direction. When the source is  $90^{\circ}$  from the axial line, there is often an angular error amounting to  $180^{\circ}$ . When the source of sound is at the nadir of the observer, the perception of its direction is absolutely unreliable. This may arise from the sound being equally reflected from the ground on all sides. I have repeated the experiment a number of times upon different individuals, but have not found one who had the slightest idea of the true direction of a sound produced beneath him."

3. In his introduction DOGIEL remarks, that the Greeks already were aware of the influence of music upon the human body, and, according to Pythagoras, music was considered as a curative agent in the treatment of certain diseases. So far, the experiments made in Vulpian's\* laboratory were the only ones known. These proved that, in dogs, the excitation of the senses (taste, smell, hearing, and vision) sometimes retarded and sometimes accelerated the number of heart-beats, but the blood-pressure was invariably increased from 6 to 8 *cm*.

The résumé of Dogiel's experiments is as follows :

a. Music exercises an influence upon the circulation of man as well as that of animals.

b. The blood-pressure may increase or may diminish. These variations of the pressure of the column of blood depend mainly upon the influence of the excitation of hearing upon the spinal cord, which, to all appearances, is in connection with the auditory nerve.

c. The effect of musical tones and utterances on animals and on man manifests itself mainly by increasing the contractions of the heart ; the automatic cardiac ganglia must, therefore, be in greater activity.

d. The variations in circulation, due to the influence of music, coincide with those of respiration, although they have also been noticed independently.

e. Strychnine increases the effect of auditory excitation upon the circulation, but curara diminishes it.

f. Chloral hydrate, as well as ethyl-alcohol and morphine (in a certain stage of narcosis), diminishes the effect of the auditory excitation upon the circulation.

g. The variations in the circulation are dependent upon the *pitch* and *intensity* of the tones and upon the *clang-tint*.

h. In these variations of the circulation the peculiarities of the animal and man exert considerable influence, as does also the nationality of the latter.

Heretofore it has been assumed that the beneficial effects of music have been due to psychical stimulation. If the increase of the blood-pressure, as Dogiel's experiments go to prove, is due to a reflex action of the cardiac nerves, which also originate in the medulla oblongata, and, thereby, the action of the cerebrum is

\*De l'influence des excitations des organes des sens sur le cœur et sur les vaisseaux. *Comptes rendus*, I, lxxxv, No. 3. Note de Messrs. Couty et A. Charpentier, présentée par M. Vulpian.



more or less impaired, then this matter is of increased importance from a hygienic standpoint. Music would then be a remedy which, without the assistance of the cerebrum, would favorably affect the functions of the heart and that of respiration also. By improving the circulation it would increase assimilation and favor physiological metamorphosis. Experience gathered at musical performances agrees, in a measure, with these experiments.

Only a short time after the music has begun we can notice a change in the audience, which points to an increase of the blood-pressure. The skin and mucous membranes are congested, particularly the auricles, the pulse is fuller, the eyes are brighter, the facial expression indicates content. The increase of warmth cannot be ascribed to the elevated temperature of the hall, because the reviewer has found that these physiological changes occur as well when the auditorium is not heated but simply illuminated by daylight, and the most careful measurements fail to detect any noteworthy changes in the temperature. That the activity of the cerebrum is not increased by the music may be inferred from the fact that not a few fall asleep during the performance.

4. FALKSON had an opportunity to study this subject on a patient in whom there had been a partial resection of the orbital cavity for the removal of a carcinoma. The opening left enabled him to gain a view of the naso-pharyngeal cavity. By adjusting a lever whose short arm rested on the velum palati while the long arm had a pencil attached to it, he was able to perceive the curves which the movements of the palate made upon the utterance of different sounds. He also describes the changes in the configuration of the naso-pharynx during phonation. We can only mention the fact that the muscular effort exerted by the soft palate during phonation, is much greater than was supposed. In order to prevent the elevation of the soft palate, the author was compelled to employ considerable force by pressing a metallic catheter on it. During respiration the soft palate was quite passive. The soft palate is raised when snoring, but the prime factors are the tremulous movements of the uvula and posterior pillars of the fauces; at the same time the root of the tongue is raised—particularly during expiratory snoring—and the *aditus faucium* is contracted. The naso-pharynx is most contracted during deglutition and most completely separated from the pharyngo-laryngeal cavity.

Unfortunately the examination of the openings of the Eus-



tachian tubes was attended with difficulty, but their appearances differed from Zaufal's and Voltolini's descriptions. Whether the conditions were due to inflammatory swelling or to some malformation could not be definitely determined.

5. As Gellé's\* and Hagen's† views as to the physiological action of the nervous supply of the tympanic mucous membrane are contradictory, BERTHOLD determined to make a series of experiments upon squirrels, in order to settle this point, and in the hopes of solving the question as to the existence and nature of the so-called trophic nerves. He deemed it best not to limit his investigations to the trigeminus, but extended them to the other two nerves supplying the tympanum, *i. e.*, the glosso-pharyngeal and sympathetic. His labors were divided into the following series :

1. Intracranial division of the fifth pair.
2. Division of one-half of the medulla oblongata in order to destroy the origin of the trigeminal nerve.
3. Extirpation of the superior sympathetic ganglion.
4. Evulsion of the glosso-pharyngeal nerve.

In consideration of the large number of squirrels (more than 100) operated on, and the great care taken in the division, Berthold's results may be looked upon as definitive, even though they may be at variance with those arrived at by Hagen. So much is settled : "that injuries of the sympathetic and glosso-pharyngeal nerves exert no influence upon the tympanic mucous membrane of the squirrel. On the other hand, injuries of the trigeminus, at its roots in the medulla oblongata, and also in the cranial cavity, anterior to the Gasserian ganglion, do cause changes in the mucous membrane of the tympanum, which pass through all the stages of inflammation from simple vascularization to purulent exudation."

Prof. Berthold will, hereafter, subject the nerves operated on to simple irritation in order to throw more light on this obscure subject.

### III.—PATHOLOGY AND THERAPEUTICS OF THE EAR.

By A. HARTMANN, BERLIN.

1. LADREIT DE LACHARRIÈRE. Deafness. Its degrees, causes, and the different apparatuses which have recently been devised for its relief. *Annal. des Mal. de l'Oreille*, etc., No. 1, 1880.

\* Gellé : Lésion de la muqueuse auriculaire à la suite des lésions bulbaires. *Gaz. Méd. de Paris*, 1878, No. 1.

† See review in these ARCHIVES, vol. ix, No. 2.

2. CRESSWELL BAKER. Report on 100 cases of ear-disease. *Lancet*, Aug. 7, 1880.
3. W. KIRCHNER, Wurzberg. Contributions to the knowledge of injuries of the ear. *Aertzl. Intelligenzbl.*, No. 30, 1880.
4. GUROVITSCH, Odessa. On the question of ear-symptoms in Bright's disease. *Berl. Med. Wochenschr.*, No. 42, 1880.
5. SAMUEL SEXTON. Tinnitus aurium. *The Amer. Journal of Otology*, vol. ii, page 193.
6. LUCHHAU, Königsberg. On diseases of the ear and eye in relapsing fever. *Virchow's Archiv*, vol. lxxxii.
7. H. KNAPP, New York. On heredito-syphilitic affections of the ear. These ARCHIVES, vol. ix, part 2.
8. D. B. ST JOHN ROOSA and E. ELY. Clinical contributions to otology. These ARCHIVES, vol. ix, part 2.
9. S. MOOS, Heidelberg. On the diseases of the ear in locomotive engineers and firemen, etc. These ARCHIVES, vol. ix, part 4.
10. CRESSWELL BAKER. Growth of fungi in ear-syringes. *British Med. Journal*, July 24, 1880.
11. A. POLITZER, Vienna. A new powder-blower. *Wiener Med. Wochenschr.*, No. 47, 1880.
12. E. ZAUFAL. On the value of the Nitze-Leiter endoscope in the examination of the ear. *Archiv f. Ohrenheilk*, vol. xvi, page 188.
13. GARDINER BROWN. New standard of measurement for hearing-power, etc. *The Lancet*, July 24, 1880.
14. G. CZARDA, Prague. On the audiphone and its usefulness in deafness. *Wien. Med. Presse*, No. 30, 1880.
15. ALFRED NORTH. Two cases of poisoning by the oil of chenopodium. *The Amer. Journal of Otology*, vol. ii, p. 197.
16. A. HARTMANN. Deaf-mute statistics of the Province of Pomerania and the District of Erfurt. These ARCHIVES, vol ix, No. 4.

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1. LADREIT DE LACHARRIÈRE first discusses the different methods of testing the hearing-power, and expresses his doubts about their value. The different diseases which may cause deafness or greatly impair hearing, such as occlusion of the external meatus, affections of the Eustachian tube, of the middle ear, the nervous apparatus, are spoken of. The author's views on hereditary syphilides and such cases, due to the exanthemata, as well as those arising from intracranial affections, appear to be based more upon his subjective reasoning than upon pathologico-anatomical

experience. In conclusion, he treats of the effects of the ear-trumpet and the audiphone. In Lacharrière's hands, as well as that of other observers, the latter was found to be of no service, but he thinks that an apparatus similar to the dentaphone has a great future. This apparatus consists of a large telephone disc, which can be fastened to the head of the speaker; its connection is like that of the dentaphone.

2. CRESSWELL BAKER reports 100 cases of ear-disease which were under his care. Among the cases especially mentioned is one in which there was an objectively perceptible crackling and subjective buzzing noise in a patient who had a perforation of the membrana tympani. The objective sound was only paroxysmal.

3. KIRCHNER reports ten cases of injury of the ear which he had seen. In three cases, children, the injury was due to a box on the ear, in two of them resulting in a rupture of a healthy drum-membrane. In the third case there was a preëxisting perforation, and the insult caused a severe inflammation of the mucous membrane of the tympanum, in consequence of which the greater part of the membrane was destroyed. Two other cases occurred in adults, in which a slight injury of the drum-membrane, by a blow, caused total permanent deafness. In two other cases there was intense irritation of the labyrinth, due to the impact of loud noises (firing a pistol and the noise of a trumpet), which caused permanent deafness. In these four cases there was a whitish-gray opacity of the drum-heads which was due to a uniform infiltration. Kirchner attributes the immunity of the labyrinth to the ability of the membrana tympani to withstand shocks. In three cases of exclusive injuries of the drum-membranes there was noticeable functional disturbance. Kirchner reviews the usual methods of treatment, and emphasizes the importance of an early and careful diagnosis in injuries of the ear.

4. GUROVITSCH begins his paper by summarizing previous communications on the subject of ear-symptoms in Bright's disease, by Rosenstein, Rayer, Dieulafoy, and then proceeds to describe his own case. In a patient who had parenchymatous nephritis, based on chronic malaria, there appeared a facial œdema of the right side, with dulness of hearing and tinnitus of the right ear, in addition to a general anasarca. On examination a perforation of the drum-head was discovered, and later, furuncles of the external meatus. As soon as the œdema extended to the left side perforative otitis media set in. *Post-mortem* examination

showed swelling and thickening of the mucous membrane of the middle ear, and slight accumulation of mucus.

6. During an epidemic of recurrent fever in Königsberg, LUCHHAU noticed the frequent occurrence of ear-complications. Among 180 cases of fever there were fifteen of affections of the ear. All of these involved the middle ear, being more or less acute inflammations. The treatment in the first stages consisted in depletion of blood; in those more advanced, in paracentesis of the drum-membrane. The prognosis was not unfavorable if the case was properly treated. Pharyngeal catarrh was only observed in a single case in which there was disease of the middle ear. The tubes were always permeable.

10. CRESSWELL BAKER, who has already called attention to the presence of fungi in ear-syringes (see these ARCHIVES, vol. viii, 406), found that, in spite of the fact that the piston was greased with carbolio vaseline, after prolonged usage a new crop of fungi had formed. He now uses a syringe whose piston is made of hard rubber which can be cleaned easily.

11. POLITZER makes use of an insufflator made, according to his directions, by Leiter, out of hard rubber. It consists of a reservoir which has a lid attached to it. A tube passes through the lower half of the receiver to which another vertical tube is attached. This tube has an oval opening on one side which corresponds with another on the floor of the reservoir, and which allows the powder to pass into the horizontal tube. By turning the tube the opening is closed and the powder can be blown out.

12. ZAUFAL maintains that the light obtained by the Nitze-Leiter apparatus is next best to sunlight, and considers its introduction as a great advance in the examination of the ear. Clear, distinct images can be obtained thereby. The expense is the only objection which can be urged against it.

13. GARDINER BROWN regrets our inability to express arithmetical values when testing hearing with the tuning-fork, and now employs von Conta's method. He applies the tuning-fork to the mastoid process of the ear examined, and determines whether its vibrations are heard a longer or shorter time than in health. If, after closing the external meatus, the vibrations of the tuning-fork are not heard longer than before, there must be some difficulty of the conducting apparatus. If it is heard longer then its increased duration will correspond with the degree of obstruction.

14. CZARDA favors the use of the audiphone, but concludes by saying that its general use is attended with difficulties.

15. NORTH reports two cases of poisoning after the administration of moderate doses of chenopodium oil. The symptoms were complicated by the presence of intense deafness and noises in the ear. The former condition continued after the subsidence of the toxic effects.

EXTERNAL EAR.

17. W. MEYER, Copenhagen. The treatment of othæmatoma. *Archiv für Ohrenheilk.*, vol. xvi, pag. 161.

18. MCLEOD, Hawick. Foreign bodies in the ear. *Brit. Med. Journ.*, July 10, 1880.

19. LÖWENBERG, Paris. The parasitic fungi of the human ear. *Gazette hebdomadaire*, No 36, 1880.

20. B. TORRANCE, Newcastle-on-Tyne. Rare case of otitis externa parasitica. *Brit. Med. Journ.*, Oct. 9, 1880.

21. A. BING, Vienna. On the history of myringitis. *Wien. Med. Blätter.*, Nos. 38, 39, 1880.

22. THOS. DILLS, Fort Wayne. A case of rupture of the drum-head from a box on the ear. *These ARCHIVES*, vol. ix, No. 2.

17. By employing massage several times daily for 15 minutes at a time, MEYER succeeded in removing the blood-clot in two cases of othæmatoma. In one case relief was afforded in one week; the second case did not persist in the treatment after complete absorption had almost taken place. In both cases the hemorrhage was binaural, and in both, either father or mother were affected with brain trouble.

18. MCLEOD, after vainly endeavoring to remove a cherry-stone impacted in the external meatus, by means of the usual methods, succeeded in doing so by means of a small apparatus which he devised for the purpose. This consisted of a small disc of leather fastened to a string; one side of it was smeared with cement and then firmly glued to the cherry-stone. After half an hour it was so firmly adherent that traction on the string succeeded in withdrawing the stone.

19. In continuation to an address on the development of fungi in the ear, delivered before the British Medical Association at Cork, LÖWENBERG draws attention to their importance in aural and general practice. As far as the ear is concerned, he agrees with Bezold that the formation of fungi in the ear is frequently due to the introduction of fatty substances. Instead of oils he there-

fore uses glycerine. Löwenberg found that the use of decomposing solutions of astringents, etc., which contained spores and rods, was also a cause of the development of fungi. This was found to be the case on examining solutions of atropia used by oculists. He therefore suggests that it would be well to boil and filter the solutions or to keep them in concentrated forms, and when used, to add a sufficient quantity of water to dilute them as desired.

20. TORRANCE, after failing in an endeavor to remove *aspergillus* by a systematic cleansing and instillation of nitrate of silver, succeeded by means of a solution of chlorate of potassa, 0.1: 30.0.

21. BING describes two cases of circumscribed myringitis. In one of them, after removing a dense, adherent layer of pus, a granulating surface was found on the anterior-inferior quadrant. Cured by the application of a concentrated solution of nitrate of silver. In the other case only that part of the membrane was inflamed which was adjacent to the handle of the malleus, swelling and congestion in this region, granulations on the short process, and to all appearances there was inflammation of the cartilaginous structure of the malleus. Treatment consisted of applications of the sesquichloride of iron and insufflations of alum.

#### MIDDLE EAR.

23. H. A. SPENCER, St. Louis. The dry treatment in suppuration of the middle ear. *American Journ. of Otology*, vol. ii, pag. 184.

24. JOS. GRUBER, Vienna. On some new methods of treating otorrhœa. *Allg. Wien. Med. Zeitung*, Nos. 28, 29, 1880.

25. A. POLITZER, Vienna. On the treatment of aural polypi. *Wien. Med. Wochenschr.*, No. 31, 1880.

26. SWAN M. BURNETT. A case of primary external mastoiditis. *These ARCHIVES*, vol. ix, part 2. p. 145.

27. F. C. HOTZ, Chicago. Abscess of the postauricular region without disease of the middle ear. *These ARCHIVES*, vol. ix, p. 250.

28. F. C. HOTZ, Chicago. The indications for an early trepanation of the mastoid process in acute purulent otitis media with implication of the mastoid cells. *These ARCHIVES*, vol. ix, No. 2, p. 156.

29. F. C. HOTZ, Chicago. Aural complaints in consequence of malaria. *These ARCHIVES*, vol. ix, No. 3, p. 241.

30. REYNOLDS. Perforation of membrana tympani from *ascaris lumbricoides*. *The Lancet*, Oct. 23, 1880.



31. ROOSA and ELY. Clinical contributions to otology. These ARCHIVES, vol. ix, p. 16.
32. FRANK ALLPORT. A case of probable abscess of the brain. *The American Journal of Otology*, vol. ii, page 189.
33. EDGAR A. BROWNE, Liverpool. A modified inflator for the middle ear. *The Lancet*, Aug. 14, 1880.
34. D. B. ST. JOHN ROOSA. A new ear douche. These ARCHIVES, vol. viii, p. 355.
35. J. GRUBER. On the therapeutic value of injections of medicated solutions into the Eustachian tube. *Monatsschr. f. Ohrenheilk.*, No. 9, 1880.
36. CLARENCE J. BLAKE. Manometric cicatrix of the membrana tympani. *The American Journal of Otology*, vol. ii, page 201.
37. ALBERT H. BUCK. Unnatural patency of the Eustachian tube. *Ibidem*, p. 203.

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23. SPENCER recommends the dry treatment in the second stage of acute purulent otitis media after perforation. The ear is cleansed by means of absorbent cotton, both before and after using Politzer; after this a tampon should be inserted which reaches to the drum-head. No air is allowed to reach the affected parts, and by absorption of the discharge the healing is favorably influenced. Several cases are reported in which, under this method, a rapid recovery ensued.

24. When using caustic solutions of nitrate of silver, GRUBER takes care that no more of the fluid be applied than the case absolutely requires. In order to prevent its exit through the tubes, the head should be bent backward and toward the other side. This treatment is contra-indicated in caries and polypoid growths. If alcohol be used, the duration of treatment will generally be longer than when nitrate of silver is the agent employed. The boracic-acid treatment is better than any of the older methods.

25. POLITZER recommends the use of alcohol for the removal of granulations and polypoid excrescences. This is to be poured into the ear and allowed to remain for from 10-15 minutes. At first these instillations are to be made three times daily; later, only once a day. If there be great pain the alcohol can be diluted with an equal quantity of water. The continued use of alcohol will effect atrophy not only of the soft polypi, but also of the tough, dense fibromata. Politzer reports several cases in which the usual

methods proved of no avail, but which were cured by the use of alcohol. The effect is almost certain, and is not liable to do any harm. The fact that it can be applied by any physician is also an advantage.

The application of alcohol is indicated in all cases of granulations and polypi which cannot be removed by operative measures, and where it is desirable that no surgical interference should be resorted to.

32. The "probable" cerebral abscess, which was "perhaps" due to an acute otitis media, occurred in a man who, during the progress of an acute otitis media, exposed himself repeatedly to inclement weather. The exposure was followed by neuralgic headaches and, later, by severe meningeal symptoms, without any recurrence of the ear-symptoms. After a sudden ejection of creamy pus from the nose, the patient died comatose. ALLPORT was not permitted to make an autopsy.

33. As, during forced expiration through the mouth, the nasal cavity is completely shut off from the pharynx by the soft palate, BROWNE suggests that in children the inflation of the ears should be done as follows: a small tube, which is connected by means of a bit of rubber tubing with Allen's nasal attachments, should be put into the child's mouth, and it should be taught to blow into its nasal cavity itself.

35. GRUBER gives us his views upon the therapeutic value of medicated injections into the Eustachian tube. They are in accordance with those generally accepted. Accumulated mucus is not dissolved by the injected fluids, but is softened and can then be more easily removed. They also are of benefit by producing a new inflammatory condition. Gruber believes that synechiæ, extending from the sides of the tympanum to either the drum-head or the ossicula, can be detached by means of injections, even though the air-douche proved of no avail. These injections can be made either through a catheter or by closing one nostril and forcing the fluid through the other canal.

36. BLAKE describes a case in which synchronous movements during respiration were observed in a cicatrix of the drum-head. During phonation they were hardly noticeable. In this, as in two other cases previously reported, the cicatrix was situated in the anterior portion of the drum-head, opposite the orifice of the Eustachian tube.

37. BUCK describes two analogous cases. In the first one

there was an oval cicatrix in the posterior-inferior quadrant showing depressions and elevations during respiration. On applying Valsalva's method there was decided bulging of the cicatrix, which collapsed as soon as the inflation ceased. In the second case the entire membrane was atrophic, probably reformed after an otorrhœa during childhood. The movements of the membrane were only observed during deglutition. We can hardly endorse Buck's opinion that in this case there was an abnormal patency of the tube. This should have been determined by means of the manometer.

NERVOUS APPARATUS.

38. D. B. ST. JOHN ROOSA, New York. The syphilitic diseases of the inner ear. These ARCHIVES, vol. viii, p. 336.

39. LADREIT DE LACHARRIÈRE. The effects of the constant current upon certain affections of the inner ear. *Annal. des Mal. de l'Oreille*, etc., No. 4, 1880.

40. V. URBANTSCHITSCH. Observations on central affections of the acoustic nerve. *Archiv f. Ohrenheilk.*, vol. xvi, p. 171.

41. BÆLZ and KAWAKAMI. The Japanese flood-fever; an acute, infectious disease. *Virchow's Archiv*, vol. lxxviii, pag. 373, 421, and 528.

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39. LADREIT DE LACHARRIÈRE believes that the sympathetic nerve exerts a greater influence upon the ear than is generally supposed. Many disturbances can be traced to changes in the vaso-motor innervation, which give rise to acute and chronic affections of the ear, combined with pathological changes in the digestive and female genital apparatus. He thinks that these are mainly due to paralytic vaso-motor congestions, and that the contractility of the vessels would be increased by the constant current. Two cases are briefly reported in which this treatment effected a cure. In reviewing the previous applications of electricity, only Bonnafont's and Duchenne's names are mentioned. Lacharrière introduces the electrodes into the external auditory canals, and deems it of great importance that the current should pass through the base of the brain.

40. The first case described by URBANTSCHITSCH was that of a hysterical woman who, in conjunction with other troubles, suffered from periodical attacks of vertigo, and subjective noises of the ear, and headache. In one ear there was total deafness; in the other,

hyperæsthesia. When a horse-shoe magnet was placed near the mastoid process of one side, the deafness passed to the hyperæsthetic side, and *vice versa*. This transfer occurred regularly, at first for the high tones, and afterward for the deep ones. A deep murmur, which was heard on the hyperæsthetic ear, became weaker with the beginning of the transfer, then disappeared, and after this only did the transfer of the tones set in. After the lapse of about six minutes, all these symptoms returned suddenly in the same rotation as they disappeared. Urbantschitsch thinks that there was no simulation. A constant current of 40 cells produced no reaction on sight or hearing on the hyperæsthetic side; after transfer they again appeared, combined with intense vertigo. When a tuning-fork or a piece of paper was used instead of the magnet, a transfer also set in. After further experiments, Urbantschitsch noticed that there was an automatic repetition of the transfer after a single application of the magnet, but unless the magnet had been previously applied, neither tuning-fork nor paper would answer. The reaction of the pupil was more sluggish on the anæsthetic side than on the other.

The second case was that of a syphilitic patient, who lost his hearing after catching cold. Although the voice was not heard, the ticking of a watch was unusually audible to him. There was no disturbance of equilibrium, nor was there nausea or vomiting. For this reason Urbantschitsch does not believe that there was any considerable labyrinthine affection. There were noticed forgetfulness, sleepiness, headache, and also paleness of both optic nerves, and specific choroiditis. The deafness due to some central lesion. Specific treatment effected a cure.

In the third case, a slight blow on the forehead of a child was followed by severe epistaxis and disturbances of equilibration, and a week later by binaural deafness. Urbantschitsch attributed the deafness here also to some central disturbance.

The fourth case was that of sudden binaural, total deafness after profuse epistaxis. *Post-mortem* revealed no cause for the above.

41. The disease described by BÆLZ makes its appearance annually, during the months of July and August, in certain districts which have been overflowed during the previous spring. It appears as an acute, non-contagious, infectious disease, with a typical febrile course; it begins with circumscribed necroses of the skin, and passes on to an enlargement of the lymphatic glands, etc.; the

ear is also affected. The most striking symptom is deafness, which is mainly of a non-inflammatory order. There is no pain, nor any disease of the nares or pharynx, nor any otorrhœa. The deafness sets in when the fever is at its height, and sometimes becomes intense; it lasts until convalescence sets it, gradually disappears, and leaves no traces behind. It is difficult to decide whether this is due to some labyrinthine affection, which disappears spontaneously, as in typhus fever, or whether it is due to the cumulative effects of the administration of quinine in large doses.

NOSE AND NASO-PHARYNX.

42. WEIL, Stuttgart. On diseases of the nose and the naso-pharynx, with demonstration of instruments and specimens. *Würt. Med. Correspondenzbl.*, No. 38, 1880.

43. G. JUSTI, Idstein. The use of dilators in diseases of the nasal cavity and the naso-pharynx. *Wien. Med. Wochenschr.*, No. 29, 1880.

44. G. JUSTI, Idstein. Indications for and application of the curette in growths of the nasal cavity and the naso-pharynx. *Ibidem*, No. 38, 1880.

45. ROTH, Vienna. Removal of a tumor, the size of a pigeon's egg, from the naso-pharynx. *Ibidem*, No. 30, 1880.

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42. WEIL briefly reviews all the diseases of the nose and naso-pharynx. We note his treatment of acute catarrh. When the catarrh begins with tickling of the throat he tries to cut it short by insufflations of boracic acid. In chronic catarrh he applies a ½-per-cent. spray of nitrate of silver, and also the galvano-cautery. Gottstein's cotton-tampons are recommended for ozæna. The author showed a specimen taken from a deaf-mute, aged 3½ years. "The entire naso-pharynx is filled with adenoid growths; Rosenmüller's fossa and the orifices of the Eustachian tubes not visible; the tubes can only be found with great difficulty. Examination of the ear shows great retraction of the drum-head and dryness of the tympanic cavity. The joints of the chain of bones are apparently intact, but the left incus is entirely detached from the stapes [artificially (?) Reviewer]. Both the long process of the incus and the posterior arch of the stapes are adherent by a dense band to the promontory. Nothing abnormal found in the labyrinth.

43. In stenosis of the nasal passages, due to hypertrophy or neoplasms, JUSTI effects dilatation by means of tents; first using laminaria, which remains in situ for thirty hours. After that a sponge tent is introduced, which must remain from fifteen to twenty hours. In a case of syphilitic disease of the nose, with granulations and caries, Justi succeeded in dilating the anterior two-thirds of the passage in such a manner that he was able to remove granulations and carious bone by means of the sharp spoon, and thus effect a cure.

44. JUSTI has operated thirty times in the naso-pharynx with the sharp spoon, and twenty-six times a single sitting sufficed to remove all excrescences from the cavity. He has employed this method with a child of three months. Justi advises the use of the sharp spoon for the removal of polypoid hypertrophies of the nasal mucous membrane and for mucous polypi (!).

45. ROTH found a tumor larger than a pigeon's egg in the naso-pharynx of a patient, which filled the cavity and originated from the lower border of the left fossa. He endeavored to pass a loop around the growth, but failed until he secured it by means of a hook attached to a string, and then passed this through the wire loop. The tumor was severed by means of the galvano-cautery. Roth was surprised that the cautery caused an inflammation of the mucous membrane, which endured for more than four weeks.